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THE IMPACT OF PEER PERFORMANCE INFORMATION ON SUBSEQUENT COOPERATION

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THE IMPACT OF PEER PERFORMANCE INFORMATION ON SUBSEQUENT COOPERATION

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Dedication

To my parents and grandparents

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The Impact of Peer Performance Information on Subsequent Cooperation

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I design an experiment to examine whether peer performance information (PPI) in an individual productive task can enhance subsequent cooperation by revealing coworker *similarities*. In groups of four, participants first individually complete either a relatively easy or difficult math task, and then engage in a public-goods game in which individual contributions are collectively beneficial but individually suboptimal. Results indicate that when group members exhibit similar individual task performance *and* when the individual task is difficult, PPI significantly increases individual contributions in the public-goods game. Conceptually, PPI in such settings reveals the challenge common to all group members, thereby establishing a social bond that enhances subsequent cooperation. Conversely, when PPI reveals dissimilar performance among group members, PPI does not appear to reduce cooperation. Overall, in contrast to the prior focus on the relative differences revealed by performance information about peers, my study suggests that PPI can increase rather than decrease subsequent cooperation by revealing individual similarities. The findings provide important practical implications on conditions under which organizations can benefit from the positive spillover effect of PPI on subsequent employee cooperation.

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Chapter 1: Introduction

In many organizations, employees work on both individual and cooperative tasks (Cohen and Bailey 1997). In an individual task, employees exert independent effort, while in a cooperative task, they have opportunities to combine resources to achieve something collectively as a group. In recent decades, the percentage of cooperative tasks at work has grown significantly (Cross, Rebele, and Grant 2016). Ranging from informal knowledge sharing to self-organized teams, employee cooperation often adds considerable value to companies (Thompson and Choi 2006). Thus, for these organizations, it is important not only to incentivize individual productivity but also to motivate collective cooperation.

In such environments, employees often also have access to information that reveals their peers' performance in individual tasks. For instance, retailers and banks often display employee performance information on leaderboards and internal information systems (O'Connell 2008; Gino and Staats 2011; Silverman 2011). In academia, schools and departments regularly update public information regarding faculty publications and research projects (Kachelmeier 2018). Even when organizations do not explicitly distribute employee performance information, several contemporary practices at work, such as regular workshops and open workspaces, allow employees to learn about their peers' work performance via direct observation (Falk and Ichino 2006; Mas and Moretti 2009). I define such information as peer performance information (PPI) and examine whether and how providing employees with PPI in an individual productive task impacts their subsequent cooperation in a cooperative task.

This research question is important because prior research on relative performance information (RPI) and social comparison suggests that organizations could face a tradeoff between the effect of PPI on employees' motivation in individual tasks and their willingness to cooperate.[1] Specifically, by inducing social comparison, PPI can motivate greater effort on individual tasks because people are concerned with how they perform relative to their peers (Hannan, Krishnan, and Newman 2008; Tafkov 2013; Wang 2017). However, psychology research suggests that social comparisons can also lead to envy and frustration (Smith 2000; Mussweiler, Rüter, and Espstude 2004), which could harm employees' willingness to cooperate with each other. Thus, to the extent that PPI reveals performance *differences* among individuals, it could increase individual productivity at the cost of subsequent employee cooperation.

In contrast to this perspective, the current study considers the possibility that PPI can reveal performance *similarities* among individuals as well as performance *differences*. In the form of absolute performance, PPI not only provides employees with relative performance feedback but also presents the overall performance distribution in the peer group. Thus, PPI can reveal either performance similarities or performance differences among group members, depending on the performance variance within the peer group. Under this premise, I examine a potential benefit of PPI on employee cooperation. Namely, I develop and test theory suggesting that PPI in an individual task can increase

[1] Relative performance information (RPI) refers to information that provides relative performance feedback to employees. PPI can be viewed as a specific type of RPI because by revealing the performance levels of peers, PPI also inform employees of their relative performance standing in the peer group.

rather than decrease employee subsequent cooperation in a cooperative task by revealing coworker similarities.

Research finds that individuals tend to bond over shared similarities (Miller, Downs, and Prentice 1998; Towry 2003; Haesebrouck, Cools, and Van den Abbeele 2017). Thus, to the extent that PPI reveals similar task performance among individuals, it should increase their subsequent cooperation. However, drawing from research in behavioral economics and psychology, I predict that the positive effect of PPI on subsequent cooperation among employees with *similar* individual task performance further depends on the difficulty of the individual task. In particular, prior studies find that people have different biases when evaluating their relative performance for difficult tasks versus easy tasks. Specifically, individuals tend to underestimate their relative performance for difficult tasks and overestimate their relative performance for easy tasks (Camerer and Lovallo 1999; Kruger 1999; Klar 2002; Hales and Kachelmeier 2009). As a result, when a task is relatively difficult, individuals expect to *underperform* others, and hence are likely to bond with coworkers over PPI that indicates that they and their peers face common challenges with similar task performance. However, when a task is relatively easy, individuals expect to *outperform* their peers, and hence are less likely to bond over PPI that reveals that their performance is, in fact, no better than their peers. In summary, I predict that when individuals have *similar* individual task performance, PPI increases subsequent cooperation to a greater extent when the individual task is difficult than when it is easy.

The social comparison literature documents that people with very different performance tend to report that they like and trust each other less (Salovey and Rodin 1984; Stapel and Kooman 2005; Dunn, Ruedy, and Schweitzer 2012). Thus, to the extent that PPI reveals *dissimilar* task performance among individuals, it should lead to social distancing rather than social bonding and decrease individuals' subsequent cooperation. Because it is unclear how task difficulty might interact with this negative effect, I predict that when individuals have *dissimilar* individual task performance, PPI reduces subsequent cooperation irrespective of the difficulty level of the individual task.

I conduct a two-stage laboratory experiment to test my predictions. In Stage 1, participants are randomly assigned to groups of four and work individually on a math task for four periods. In each period, participants have a maximum of three minutes to solve as many two-digit multiplication problems as possible, with the option to end the period early and relax. To avoid potential confounds from wealth effects and pay comparisons, all participants receive fixed pay for performing the math task irrespective of the number of problems solved.

I employ a 2 × 2 × 2 between-subject design with two *manipulated* factors and one *measured* factor. I manipulate the presence of PPI for the Stage 1 math task by providing participants with only their own performance or by providing the performance of all participants within their group. I manipulate the difficulty level of the Stage 1 math task by either allowing or disallowing participants to use pen and paper to solve the two-digit multiplication problems. In addition to the two manipulated factors, I measure performance variance for each group and classify participants as being in a group with

similar task performance if the group's Stage 1 task performance variance is below the median of the assigned condition, and as being in a group with *dissimilar* task performance if its performance variance is at or above the median.

After completing Stage 1, participants proceed to Stage 2 to complete a public-goods game within the same group of four. In this game, participants start with 100 points and decide how many points to invest in a group project. The total number of points invested by all four participants in a group is then doubled and redistributed equally to the four participants. In this setting, contributing to the group project is collectively beneficial but individually suboptimal, such that the dominant strategy is not to contribute, even though cooperation can yield a Pareto superior outcome for all group members. I use the number of points a participant contributes to the group project as a proxy for his/her willingness to cooperate with other group members.

Results indicate that the effect of PPI in Stage 1 on participants' cooperation in Stage 2 depends on *both* performance similarity and task difficulty level in Stage 1. In particular, when group members exhibit *similar* performance in the Stage 1 math task, PPI significantly increases individual contributions in the public-goods game in the High Difficulty condition (no pen or paper allowed to solve the multiplication problems) but not in the Low Difficulty condition (pen and paper allowed). Consistent with my hypothesis, this finding suggests that, when revealing group members' similar task performance in a difficult individual task, PPI establishes a social bond that enhances subsequent cooperation by revealing a common challenge shared by all group members.

When group members have *dissimilar* performance in the Stage 1 math task, however, I do not find a harmful effect of PPI on subsequent cooperation with the exception of top performers in the high-difficulty condition. In particular, I find some evidence that when task difficulty is high, providing PPI marginally decreases individual contributions for participants ranking first and second in groups with dissimilar peer performance, while having little effect on other participants. In summary, these findings underscore the importance of considering the level of employee performance similarities when evaluating the effect of PPI.

In supplemental analyses, my results confirm the motivational benefit of PPI in individual tasks found in prior studies (e.g., Tafkov 2013; Wang 2017). Specifically, in the Stage 1 math task, I find that providing PPI significantly increases the amount of time participants voluntarily spend on the multiplication problems, even though their fixed compensation in the Stage 1 task does not depend on either absolute or relative task performance. This result suggests that organizations potentially benefit in both individual productivity and employee cooperation via the provision of PPI.

This study has several implications for research and practice. First, it contributes to a growing literature examining the effects of performance information about peers (e.g., Hannan, McPhee, Newman, and Tafkov 2013; Tafkov 2013; Newman and Tafkov 2014; Kramer, Maas, and Rinsum 2016; Wang 2017; Chan 2018; Hannan, McPhee, Newman, and Tafkov 2018). While prior research finds that performance information about peers can influence individual behavior by emphasizing performance *differences* among individuals (e.g., providing performance ranking information or recognizing the

best performer), my study suggests that performance information about peers can also influence individual behavior by revealing performance *similarities*. In particular, I find that informing individuals that they share similar performance in a challenging individual task leads coworkers to be more likely to cooperate with each other in a subsequent cooperative task.

Second, my study documents a conceptually distinct advantage of PPI in addition to the motivational benefit found in prior research (e.g., Tafkov 2013; Hannan et al. 2013; Wang 2017). By identifying performance similarity and task difficulty as two important moderators of the effect of PPI, my study provides implications on the specific settings in which organizations can benefit from the positive spillover effect of PPI on cooperation. As PPI is effective in bonding employees when revealing common challenges shared by peers, organizations can consider facilitating employees with the access to PPI among new recruits, when a challenging task is introduced, or during difficult times.

Furthermore, this study answers the call for more attention to workforce composition in managerial accounting research (Luft 2016). My results show that receiving PPI in a difficult task can promote cooperation among employees with similar performance, but has limited impact on subsequent cooperation among employees with dissimilar performance. Building on research by Arnold, Hannan, and Tafkov (2018) and Chan, Kachelmeier, and Zhang (2018), my study suggests that the level of performance similarities among workers is an important factor that moderates the effectiveness of management control practices.

Lastly, this study also contributes to the literature that examines the effect of management control practices on employee cooperation (e.g., Chen, Williamson, and Zhou 2012; Haesebrouck, Van den Abbeele, and Williamson 2015; Kachelmeier, Williamson, and Zhang 2017; Thomas and Thornock 2017; Arnold, Hannan, and Tafkov 2017). While prior research focuses on the effect of incentives and feedback directly related to the cooperative task, my study suggests that providing employees with performance feedback (i.e., PPI) on a separate individual task can also have important spillover effects on subsequent employee cooperation.

The remainder of this dissertation is structured as follows. In Chapter 2, I review and discuss prior studies that examine the behavioral effect of RPI. Chapter 3 develops the main hypotheses. Chapter 4 describes the laboratory experimental design and procedures. Chapter 5 presents the tests of the main hypotheses and a series of supplemental analyses. In Chapter 6, I provide the concluding remarks and discuss future research opportunities.

Chapter 2: Review and Discussion of the RPI Literature

Background

Many organizations provide employees with information about their peers' performance. For example, in academia, schools and departments regularly update information regarding the latest publications and research projects of the faculty members on websites and newsletters (Kachelmeier 2018). In some universities, faculty members also have access to their colleagues' teaching evaluation scores (Rosen 2017). Similarly, in the corporate world, call centers, retailers, and banks also often display employee performance information on leaderboards or internal feedback systems (O'Connell 2008; Blanes i Vidal and Nossol 2011; Gino and Staats 2011).

Even when organizations do not explicitly disseminate employee performance information, employees have many opportunities to obtain peers' performance information by observing those who work in proximity (Towry 2003; Mas and Moretti 2009; Corsello and Minor 2017). This is consistent with evidence that peer performance appraisals have well-established predictive validity and reliability (Kane and Lawler 1978; Schmitt, Gooding, Noe, and Kirsch 1984). Several contemporary practices at work likely further facilitate employees' direct access to peer performance. For example, technology firms and research institutions often hold regular meetings and workshops at which employees present their work (Florida and Goodnight 2005). A growing number of organizations have adopted common and open workspaces in which employees can more easily observe the work progress of others (Mas and Moretti 2009; Waber, Magnolfi, and Lindsay 2014; Nielsen 2016).

One important feedback employees can obtain from peers' performance information is their relative performance standing in the peer group. One stream of studies in managerial accounting refers to such feedback as relative performance information (i.e., RPI), and examines its effect on individual behavior. Below I review the RPI literature and discuss its implications to for the current study.

Review of the RPI Literature

The RPI literature draws on social comparison theory to examine whether and how RPI influences individual behavior by revealing performance *differences* among individuals. Social comparison theory states that individuals have an innate desire to compare themselves with others to evaluate or improve some aspects about the self (Festinger 1954; Gibbons and Buunk 1999; Suls and Wheeler 2000). As such, the outcome of social comparison has a significant influence on one's self-image if it reveals that individuals are *different* from others in the aspect of interest (Suls, Martin, and Wheeler 2002). Specifically, when outperforming others, individuals receive positive feedback on the self, and their self-image enhances (Gibbons and Gerrad 1997; Tesser et al. 2000). In contrast, self-image suffers when underperforming others (Mussweiler and Strack 2000; Moore 2007). Thus, in the presence of RPI, the incentive to keep a positive self-image motivates individuals to engage in costly actions to achieve better relative standing even though outperforming others does not confer monetary or other tangible benefits.[2]

[2] Another literature examines the motivational effect of incorporating RPI in compensation contracts (e.g., tournament). In contrast to the RPI literature, this literature relies on economic theory that RPI filters out common uncertainty shared by agents and induces employee effort in a less costly manner (Lazear and Rosen 1981; Holmstrom 1982; Nalebuff and Stiglize 1983; Frederickson 1992).

Consistent with this argument, a number of experimental studies document robust evidence that the mere presence of RPI can lead to greater effort and better performance from individuals under both flat wage (Tafkov 2013; Hannan et al. 2013; Kramer, Maas, and van Rinsum 2016; Wang 2017) and piece-rate incentive schemes (Hannan et al. 2008; Tafkov 2013).[3] However, the motivational drive to get ahead of peers can also come at a cost. When the productive effort is not the only way to outperform others, research finds that RPI can lead to various counterproductive activities, including distorted effort allocation across different tasks (Hannan et al. 2013), dishonest performance reporting (Brown, Fisher, Sooy, and Sprinkle 2014), and sabotage activities that undermine peers' performance (Wang 2017).

Prior research also finds that the effect of RPI on both productive and counterproductive behavior can be magnified when certain attributes of RPI emphasize or enlarge the performance difference among individuals. For example, compared to private RPI, public RPI has a stronger effect on both productive effort and distorted effort allocation (Tafkov 2013; Hannan et al. 2013). Similarly, in a multi-task setting, RPI that is based on cumulative performance over multiple periods leads to more distorted effort allocation than RPI that is reset each period (Hannan et al. 2018). The moderating effect of these RPI features further supports that the behavioral effect of RPI is driven by revealing performance *differences* among individuals and inducing social comparison.

[3] Hannan et al. (2008) and Newman and Tafkov (2015) examine the motivational effectiveness of RPI under a tournament incentive scheme. The results suggest that RPI hurts performance if the tournament only rewards the top performer but improves performance if the tournament both rewards the top performers and punishes the bottom performers.

Discussion of the RPI Literature

As noted above, a commonality shared by prior RPI studies is the focus on how performance information about peers influences behavior by highlighting relative *differences* among individuals. This focus is reflected by the literature's strong reliance on social comparison theory. In particular, most of the behavioral effects documented in the literature result from the comparison people make when learning how they perform relative to others and are moderated by factors that influence the strength of such comparison. Furthermore, to facilitate the testing of social comparison theory, prior studies predominantly operationalize RPI as performance information in relative forms such as ranking information (e.g.,Tafkov 2013; Hannan et al. 2013; Hannan et al. 2018) or information about whether a participant's performance is the best in a peer group (e.g., Wang 2017). [4] As such, any performance difference among individuals, despite its actual level, is made salient to participants. Although the perspective that RPI highlights individual differences has provided insightful implications in the literature, it may limit a complete understanding of the role of performance information about peers in practice. In contrast to this perspective, the current study considers the possibility that performance information about peers can reveal performance *similarities* among individuals as well as performance differences.

[4] There are two exceptions. Kramer, Maas, and Rinsum (2016) examine the motivational effect of RPI in the form of rank versus absolute performance and do not find a significant difference. Hannan et al. (2018) examine the effect of RPI in the form of rank versus absolute performance (referred to as "actual-score RPI") on effort distortion in multi-task setting. They do not find that effort distortion significantly differs between the two conditions when RPI is reset every period; however, effort distortion is significantly higher in the actual-score RPI condition than in the rank-score RPI condition when RPI is cumulative over all periods. Both studies argue that relative to rankings, actual-score RPI provides more detailed information about the performance differences between individuals, and do not examine whether the effect of actual-score RPI depends on performance similarity between individuals.

In practice, performance information about peers is often in the form of absolute performance information, i.e., PPI. First, anecdotal evidence suggests that explicit performance rankings are becoming less available as companies who were known for providing relative performance feedback (e.g., Accenture, Adobe, GE, and Microsoft) have restructured their performance review practices to reduce unhealthy competition among employees (Cappelli and Tavis 2016; Rock and Jones 2015). Moreover, when organizations make employees' performance information accessible, the intent is also often to acknowledge joint progress rather than to emphasize performance differences between employees (Kachemeier 2018).

The absolute performance feedback from PPI contains broader information than feedback on relative differences among individuals. While employees can still learn their relative performance, PPI also reveals the overall performance distribution in the peer group. Thus, PPI can reveal performance *similarities* among group members, depending on the performance variance within the peer group. Take the two groups in Figure 1 as an example. The relative position of each member in the group is the same across the two groups, but members of Group A have more similar performance than members of Group B. If only receiving ranking information, members in both groups would receive the same relative performance feedback that highlights the differences in their performance. In contrast, if each group member instead receives PPI, i.e., the absolute performance level of their peers, although the relative feedback is still available, PPI also reveals that members in Group A exhibit similar task performance, whereas members in Group B have very dissimilar task performance.

It is important to acknowledge that PPI can reveal individual performance *similarities* as well as differences for at least two reasons. First, organizations often make a significant investment in time and resources to select and recruit employees. Thus, even though employees can have various expertise and backgrounds, it is likely that employees considered as peers in one organization have relatively comparable ability and performance (Chow 1983; Kachelmeier and Williamson 2010; Cardinales, Chen, and Yin 2018). Thus, from the perspective of providing practical implications, it is important to understand the effect of PPI in the setting where employees share similar performance.

Second, I next develop and test theory suggesting that the effect of PPI on employee cooperation likely depends on whether PPI reveals similarities or dissimilarities among peers. Prior RPI and social comparison literature suggest that the social comparison process induced by PPI can lead to envy and frustration (e.g., Smith 2000), which could harm employees' willingness to cooperate with each other (Tafkov 2013). In contrast to this perspective, I examine whether PPI can instead enhance subsequent cooperation in a cooperative task by revealing performance similarities shared by co-workers. I develop this prediction in the next chapter.

Chapter 3: Hypotheses Development

Employee Cooperation

Employee cooperation refers to the process in which a group of employees voluntarily exert and coordinate cooperative effort to achieve a common goal (Brief and Motowidlo 1986). As business becomes more cross-functional and workplaces become more open, there is an increasing number of opportunities for employees to cooperate with each other even when they do not belong to a formal team structure. For example, employees can share knowledge and information, form self-organized teams, and offer support and help with work-related tasks. By efficiently incorporating various expertise and resources, employee cooperation often creates significant value to organizations (Padsakoff, Whiting, and Podsakoff 2009). For example, prior research finds that cooperative effort among employees is more effective than individual effort in solving difficult problems (Klein and Epley 2015), generating innovative outcomes (Milliken, Bartel, Kurtzberg 2003), and improving firm performance (Grant and Partil 2012).

Despite the benefits to organizations, the defining characteristic of a decision to cooperate with others is that it is individually costly (Cross et al. 2016; Arnold et al. 2018). While the involvement in cooperative activities often consumes a significant amount of personal time and resources, individual contribution is difficult to measure and reward (Sprinkle and Williamson 2006). Prior research finds that employees who are known as givers at work often suffer in their own job prospects (Grant 2013). Given this "public-goods" nature of cooperation, organizations are eager to motivate employee cooperation. For example, Google launched an internal research project, Project Aristotle,

that was dedicated improving employee cooperation (Duhigg 2016). Similarly, Apple recently built a new campus that was designed to enhance employee cooperation (Hess 2017).

Prior research finds that team-based incentives and other formal control mechanisms can increase cooperation by rewarding cooperative behavior and punishing uncooperative behavior (e.g., Coletti, Sedatole, and Towry 2005; Chen et al. 2012). However, it is still important to understand various factors that can influence employees' willingness to cooperate with their peers in the absence of management control mechanisms directly related to the cooperative task. First, given employee cooperation is often spontaneous and outside the formal team structure, it is difficult to enforce management control for all cooperative opportunities. Second, even in the presence of a formal control mechanism, its effectiveness often also depends on the extent to which an employee cares about the success of the group as a whole (Towry 2003; Maas and Yin 2018).

In this study, I argue that PPI on an individual productive task has an important spillover effect on employee cooperation in a subsequent unrelated task.[5] In particular, I develop hypotheses suggesting that PPI can influence individuals' willingness to cooperate with peers, with the influence likely to depend on whether PPI reveals similar or dissimilar performance.

[5] I focus on the effect of PPI of an *individual* productive task on employee subsequent cooperation as opposed to the effect PPI in *collaborative* tasks (see Arnold et al. 2017; Thomas and Thornock 2017).

H1 - Peers with Similar Performance

People often favor those who are similar to them over those who are dissimilar (Campbell 1958; McPherson, Smith-Lovin, and Cook 2001). Research presents abundant evidence of the bonding effect of similarity, ranging from important commonality in personal traits, values, and interests (Byrne, Clore, and Smeaton 1986) to trivial resemblance in T-shirt color, birthdate, and accidental food choice (Miller, Downs, and Prentice 1998; Towry 2003; Wolley and Fishbach 2018). As a result, individuals sharing similarities tend to care more about the interests of each other (Cialdini and Trost 1998) and are more likely to help each other (Haesebrouck et al. 2017). Hence, to the extent that PPI reveals similar performance among peers, PPI should increase individuals' willingness to cooperate with peers and contribute to the group's success.

However, other research challenges the notion that "birds of a feather flock together" and suggests that individuals do not always prefer being similar (Ariely and Levav 2000; Amodio and Showers 2005). Theory suggests that when people expect to be unique, they intentionally diverge from similar others to differentiate themselves (Lynn and Snyder 2002; Berger and Heath 2008). Thus, evidence suggests that the relationship between perceived similarities and cooperation depends on whether individuals *value* such similarities, or whether such similarity is consistent with maintaining or enhancing one's positive self-image. Drawing from behavioral economics and psychology, I argue that when individuals have similar performance in an individual task, the difficulty level of the individual task is likely to moderate the effect of PPI on their subsequent

willingness to cooperate because it affects the extent to which individuals respond favorably to the information that they have similar performance with peers.

Moderating Effect of Task Difficulty

Although the traditional perspective in behavioral economics and social psychology is that people tend to be overconfident about themselves and overestimate their relative performance (Camerer and Lovallo 1999), recent research challenges this perspective by finding that people are systematically underconfident in some domains (Kruger 1999; Klar 2002; Moore and Cain 2007; Hales and Kachelmeier 2009). In particular, research documents that while individuals tend to overestimate their relative performance for easy tasks ("better-than-average" bias), they also tend to underestimate their relative performance for difficult tasks ("worse-than-average" bias) (Camerer and Lovallo 1999; Kruger 1999; Klar 2002; Hales and Kachelmeier 2009).

The typical explanation for this phenomenon is that people tend to anchor on their perceived absolute performance when assessing their relative performance (Kruger 1999; Moore 2007). That is, if people view a task as being difficult, they will underweight the fact that the task would also be challenging for other people. In contrast, if people view a task as being easy, they will fail to adequately calibrate for the fact that other people will also find the task to be easy. Accordingly, people tend to underestimate their relative performance for difficult tasks and overestimate their relative performance for easy tasks.

Because people have different relative expectations for difficult and easy tasks, the effect of information revealing similar performance is likely to depend on task difficulty. In particular, when a task is difficult, individuals expect to underperform

others and hence should react favorably upon learning from PPI that they and their peers share similar performance. Specifically, by revealing the similar task performance among peers, PPI also reveals the challenge common to all group members, thereby establishing a social bond over the revelation of "we are in this together" which in turn enhances subsequent cooperation. However, when a task is easy, individuals expect to outperform their peers and hence are less likely to respond favorably to PPI indicating that their performance is, in fact, no better than their peers. As a result, I predict that any social bonding precipitated by PPI will be more evident when the task is difficult than when it is easy. I state this prediction in the following hypothesis.

> **H1:** When individuals in a peer group share similar individual task performance, PPI on the individual task increases individuals' subsequent willingness to cooperate with peers to a greater extent when the individual task is difficult than when it is easy.

H2 - Peers with Dissimilar Performance

Prior research suggests that performance information that reveals differences between individuals can impair interpersonal relationships (Smith 2000; Buunk and Gibbons 2007). In particular, the social comparison literature documents that people tend to disassociate from outperforming others to maintain a favorable image (Tesser 1988; Dunn et al. 2012). For example, prior studies find that participants report jealousy toward a virtual person depicted as better than them (Salovey and Rodin 1984), rate friends as less close when friends outperform them (Tesser et al. 2000), and view a confederate with better performance as being less trustworthy (Dunn, Ruedy, and Schuweitzer 2012). Similarly, prior research also shows that people tend to be reluctant to associate with less successful groups and individuals (Cialdini and Richardson 1980; Snyder, Lassegard, and

Ford 1986; Ross and Wilson 2002; Stapel and Kooman 2005; Dunn et al. 2012). Overall, these findings suggest that individuals with different task performance are more likely to distance from each other rather than bond with each other, thus painting a pessimistic picture of the effect of information that reveals performance differences among individuals on their subsequent cooperation. Therefore, I expect PPI to decrease individuals' willingness to cooperate when they have dissimilar individual task performance, on average.

To the extent that PPI decreases individual cooperation when performance similarity is low, it is unclear whether the adverse effect of PPI is stronger when the individual task is easy or when it is difficult. On the one hand, given that individuals tend to be overconfident about their relative performance on easy tasks, any alienating effect of PPI should be stronger for easy tasks. On the other hand, individuals tend to care more about their performance and exert greater effort for difficult tasks that can be more sensitive to ability. Consistent with this argument, Newman et al. (2017) find that losing a tournament for a difficult task has a more detrimental effect on altruistic behavior than losing a tournament for an easy task. As such, I do not predict an interaction between PPI and task difficulty when individuals have dissimilar task performance. I state my prediction in the following hypothesis.

> **H2:** When individuals in a peer group have dissimilar individual task performance, PPI on the individual task decreases individuals' subsequent willingness to cooperate with peers, irrespective of the difficulty level of the individual task.

Chapter 4: Method and Design

Participants

I design and conduct my study in a dedicated research laboratory using z-Tree software (Fischbacher 2007).[6] I recruit 192 student volunteers from the business school of a large public university to participate in experimental sessions that last approximately 60 minutes.[7] The average age of participants is 20.6 years old, and 58 percent of the participants are female.

Experimental Procedure and Tasks

Figure 2 illustrates the experimental procedures. Upon entering the lab, participants randomly draw a seat number that assigns them to a pre-numbered computer terminal. The seat number also serves as an identifier to ensure that participants' information remains confidential. After being seated at a computer, participants listen to the experimenter read the first set of instructions while following along from paper-based instructions (see Appendix A). The instructions inform participants that people sitting at the four adjacent computer terminals are assigned to one group, with groups remaining the same throughout the study. Participants also learn the study includes two main stages and receive detailed instructions about the Stage 1 task. To ensure their understanding of the Stage 1 task, participants complete a computerized comprehension quiz before proceeding to it.

[6] This study is approved by my university's Institutional Review Board.
[7] I performed three administrations: two in the summer and one in the fall. The inferences of the hypotheses tests remain the same if I control for the individual administration or whether the administration was conducted in the summer.

In the Stage 1 task, participants individually solve two-digit multiplication problems for four work periods. In each period, participants receive 12 problems on their computer screen, and their task is to input an answer to each problem. Appendix C presents the Stage 1 task z-Tree screen for each work period. Participants have a maximum of 180 seconds (three minutes) each period to work on the task. However, they can choose to end the work period at any time before the period ends. If a participant chooses to end the work period early, s/he cannot restart the work period but can relax or read newspapers provided at the workstation until the next work period begins. Participants receive fixed pay of $8 for completing the Stage 1 task, irrespective of the number of problems correctly solved.

After finishing the all four work periods comprising Stage 1, participants receive paper-based instructions about the Stage 2 task (see Appendix B) and proceed to this task after completing another comprehension quiz on the task instructions. In the Stage 2 task, participants perform a one-period public-goods game with the other three participants in the assigned group. This task captures individuals' willingness to cooperate with their peers. At the beginning of the task, the four participants in a group each receive 100 points. Each participant decides how many of the 100 points to invest in a group project in increments of 10 points and keeps the rest of the 100 points. The total number of points the four participants invest in the group project is doubled and is then redistributed equally to the four participants. I also ask participants to estimate the average number of points the other three participants will invest in the group project. To encourage accurate estimation, I provide participants with a 10-point bonus if their estimation is within 10

points of the actual average. Participants' total payoff in the Stage 2 task is the sum of the points they do not invest, the points allocated from the group project, and a bonus of 10 points if the estimation is within 10 points of the actual average. Participants' decisions are kept anonymous from other participants in their group, and participants do not learn their payoff in the Stage 2 task until they complete a post-experimental questionnaire.

After completing the Stage 2 task, participants complete a post-experimental questionnaire that elicits supplemental responses and demographic information. After participants finish the questionnaire, the computer screen informs participants of the number of points participants earned in the Stage 2 task. As indicated in the instructions, the points are converted to U.S. dollars at the rate of 10 points = $1.00. Including the $8.00 fixed compensation for completing the Stage 1 task, participants earn an average of $24.95, ranging from $15.00 to $34.00.

Several features of the experimental task warrant additional comments. First, I use two-digit multiplication problems as the Stage 1 task. The multiplication task satisfies three basic requirements that encourage social comparison and competitive behavior to improve individual task performance (Tafkov 2013). The three requirements are (1) comparison task similarity: participants know that other participants receive the same set of multiplication problems each period; (2) comparison target similarity: participants are recruited from business school classes and have similar related attributes; (3) comparison domain importance: the general problem-solving ability required by the multiplication task is important to individuals. Because this study aims to test the theory about whether social comparison information can increase rather than decrease

cooperation among individuals, it is important to have a task that could induce social comparison among participants.

Second, I choose to use fixed pay for the Stage 1 math task to avoid the potential for monetary consequences of Stage 1 possibly confounding the degree of cooperation in Stage 2.[8] This setting is realistic given that fixed pay is commonly observed in practice (Baker et al. 1988; Hannan et al. 2013). Still, I acknowledge that, in practice, employees sometimes receive performance-based pay for certain individual tasks. In an extreme nonlinear incentive scheme such as a winner-takes-all tournament, the effect of PPI could differ because workers could receive very different pay despite similar task performance. However, to the extent that incentives for the individual task are approximately linear to task performance (i.e., individuals with similar levels of task performance receive similar pay), I expect that the effect of PPI on cooperation to generalize because the performance similarities or dissimilarities revealed by PPI would be consistent with the variation in pay.

Third, the abstract public-goods game I operationalize as the Stage 2 task is unrelated to the Stage 1 task. I make the design choice that the individual task and the cooperative task are unrelated because my theory grounded on social bonding/distancing over similar/dissimilar task performance does not require an association between the two tasks. This design choice affords a clean test of the theory underlying my hypotheses because if the two tasks were related, there could be alternative reasons why PPI in the Stage 1 task might influence individuals' willingness to cooperate in Stage 2. Moreover,

[8] Prior research provides evidence that endowment heterogeneity can influence contribution decision in a public-goods setting (e.g., Cherry, Kroll, and Shogren 2005; Heap, Ramalingam, and Stoddard 2016).

even in practice, it is realistic that cooperative and individual tasks are often in unrelated areas and require different skill sets. Although abstract, the public-goods game task captures the complementary nature of cooperation in practice, as the final cooperative output is greater than the sum of the individual inputs. Thus, I expect that my findings would likely generalize to settings in which the cooperative task is a productive task.

Experimental Design

I employ a 2 × 2 × 2 between-subjects design that manipulates the availability of PPI and the difficulty level of the Stage 1 task and measures performance similarity in each group.

I manipulate the availability of PPI by varying the Stage 1 task performance feedback received by participants after each work period and at the end of the task. In the No PPI condition, participants see the answer they submit for each problem and their performance (i.e., the number of problems correctly solved) after each period, along with a performance summary for all four periods at the end of Stage 1. In the PPI condition, in addition to feedback on their own performance, participants also see the answers and performance of each of the other three participants in their group. Figure 3 illustrates the performance feedback provided in each condition.

I manipulate the difficulty level of the Stage 1 task by either allowing or disallowing participants to use pen and paper to solve the two-digit multiplication problems.[9] In the Stage 1 task, participants in all conditions receive the same four sets of

[9] In a contemporaneous study, Newman, Tafkov, and Zhou (2017) compare the negative effect of losing in tournament for difficult and easy individual tasks on prosocial behavior. They manipulate whether a task is difficult or easy by using two two-digit numbers for each problem (e.g. 42 × 48) in the difficult task condition and one-digit number by a two-digit numbers (e.g. 2 × 48) in the easy task condition.

math problems and are instructed not to use a calculator. However, participants in the Low Difficulty condition are provided with pen and paper for solving the problems. In contrast, participants in the High Difficulty condition do not receive pen or paper and are also explicitly instructed they must solve the problems without pen and paper.

After collecting all data, I measure the performance variance of the Stage 1 task for each group and the median of the performance variance in each of the four assigned conditions. The median performance variance for each condition is 3.61 (No PPI and High Difficulty), 2.77 (PPI and High Difficulty), 4.39 (No PPI and Low Difficulty), and 2.67 (PPI and Low Difficulty). A Wilcoxon-Mann-Whitney test suggests there is no significant difference between the median variance of any two conditions (all two-tailed $p > 0.315$). I rely on the random assignment of participants to each group to generate meaningful differences in performance variance across groups. I classify a participant as being in Similar Performance condition if the performance variance of his/her group is below the median for the respective treatment condition, and as being in the Dissimilar Performance condition if at or above the condition median.[10]

[10] The direction and inferences of the main results remain unchanged if I exclude the eight participants at the median, include the eight participants at the median in the Similar Performance condition, use the full sample median, or classify participants as being in the Dissimilar Performance condition if performance variance of their group is at the bottom tercile.

Chapter 5: Results

Manipulation Checks

To check my manipulation of task difficulty, the post-experiment questionnaire asks participants to indicate their level of agreement with the statement, "I found the Stage 1 task *challenging*," on a 7-point Likert-scale with endpoints of "Do not agree at all" (1) and "Very much agree" (7). An untabulated t-test shows that participants who cannot use pen and paper in the Stage 1 task perceive the task as more challenging (mean = 5.86) than participants who can use pen and paper (mean = 4.42), for a significant difference of 1.44 (t_{190} = -7.32; $p < 0.01$, two-tailed). Consistent with these responses, participants who cannot use pen and paper on average solve significantly fewer multiplication problems (mean = 15.33) than those who can (mean = 31.70; t_{190} = 12.21; $p < 0.01$, two-tailed). Hence, I conclude that the task difficulty manipulation is successful.

I also check the validity of the performance similarity measure. The post-experimental questionnaire asks participants to indicate the extent to which they agree with the statement, "I feel *similar* to my group members" on a 7-point Likert scale with endpoints of "Do not agree at all" (1) and "Very much agree" (7). In an untabulated ANOVA analysis, I find participants in the measured Similar Performance condition agree more with the statement than participants in the Dissimilar Performance condition ($F_{1,188}$ = 4.98; p = 0.03, two-tailed). In turn, this difference is driven primarily by participants in the PPI condition, as indicated by a significant interaction between performance similarity and PPI on perceived similarity ($F_{1,188}$ = 6.35; p = 0.01, two-tailed). In particular, in the presence of PPI, the mean in the Similar Performance condition is

4.43, and the mean in the Dissimilar Performance condition is 3.63 ($F_{1,188}$ = 10.84; p < 0.01, two-tailed). In contrast, in the absence of PPI, there is no significant difference in the extent of agreement between participants in the Similar Performance condition (mean = 3.56) and the Dissimilar Performance condition (mean = 3.69; $F_{1,188}$ = 0.04; p = 0.84, two-tailed). This evidence confirms that the measured performance similarity condition successfully distinguishes groups with members of similar Stage 1 task performance from groups with members of dissimilar Stage 1 task performance as long as with PPI revealing this distinction.

Effect of PPI on Contribution

I measure each participant's willingness to cooperate with peers using the number of points a participant invests in the Stage 2 public-goods game and refer to this variable as Contribution. H1 predicts that, when individuals have similar performance in an individual productive task, PPI increases Contribution when the individual productive task is difficult to a greater extent than when the individual productive task is easy. When individuals have dissimilar task performance in an individual productive task, H2 predicts that PPI decreases Contribution irrespective of the difficulty level of the individual productive task. Together, these two hypotheses imply a three-way interaction in the full sample, a significant two-way interaction between PPI and task difficulty in the subsample in which individual performance is similar in the peer group, and a significant main effect of PPI in the subsample in which individual performance is dissimilar in the peer group.

Figure 4 presents the mean Contribution for each condition. In the Similar Performance condition (Panel A), PPI appears to increase Contribution when task difficulty is high but has no apparent effect when task difficulty is low. In the Dissimilar Performance condition (Panel B), PPI appears to have no overall effect irrespective of task difficulty.

To test my hypotheses, I conduct a three-way ANCOVA with Contribution as the dependent variable, and PPI (PPI versus No PPI), Performance Similarity (Similar versus Dissimilar), and Task Difficulty (High versus Low) as independent factors.[11] I also include participants' social value orientation (SVO) as a covariate. SVO is an indicator variable that equals one if an individual is classified as a prosocial person and zero if otherwise, based on the instruments developed by Van Lange et al. (1997).[12] I use SVO to control for the variation in participants' innate inclination to cooperate that is independent of my manipulation (Balliet, Parks, and Joireman 2009).[13]

[11] Because there is no interaction between group members and each individual makes the decision in the public-goods game independently, I treat the Contribution of each participant as an independent observation. To ensure the assumption of independence, I compare the variance of Contribution within each four-people group in the study with the variance of Contribution within four ex-post randomly-matched participants. I do not find any significant difference ($t_{191} = 0.53$; $p = 0.60$, two-tailed), supporting the assumption of independence. In addition, the main results are robust to regression analyses clustered on groups.

[12] In the instruments, participants answer nine questions in which they hypothetically decide payoff for themselves and another person. For each question, participants choose between a competitive option that maximizes the difference between their payoffs and the other's, an individual option that maximizes their own payoff, and a prosocial option that maximizes the joint payoff of themselves and the other person. A participant is classified as a proself agent if consistently choosing the prosocial option for at least six times and proself otherwise.

[13] As expected, Table 1 shows that SVO has a significant relationship with Contribution ($F_{1,183} = 4.56$; $p = 0.03$, two-tailed), confirming that SVO is an important covariate. However, in untabulated analyses, the three-way interaction remains significant without the control variable SVO ($F_{1,184} = 3.15$; $p = 0.08$, two-tailed). Other demographic information such as the gender and the age is not significantly associated with Contribution so I do not include these variables as covariates.

Panel B of Table 1 reports the ANCOVA results, which show a significant three-way interaction ($F_{1,183}$ = 3.39; p = 0.07, two-tailed), indicating that the effect of PPI on Contribution depends on both Performance Similarity and Task Difficulty. Untabulated analyses confirm that the interaction effect is robust after controlling for the amount of time participants spend in the Stage 1 task ($F_{1,182}$ = 3.20; p = 0.08, two-tailed) or participants' Stage 1 task performance ($F_{1,182}$ = 2.93; p = 0.09, two-tailed).[14] Next, I conduct separate analyses in the Similar Performance and Dissimilar Performance conditions, respectively.

Test of H1: Peers with Similar Performance

Panel A of Table 2 documents the results for participants in the Similar Performance condition. Consistent with H1, I find a significant two-way interaction between PPI and Task Difficulty on Contribution ($F_{1,87}$ = 2.99; p = 0.04, one-tailed).[15] Follow-up analysis on this significant interaction effect, reported in Panel B of Table 2, shows that Contribution is significantly higher in the PPI condition than in the No PPI condition when task difficulty is high ($F_{1,87}$ = 5.39; p = 0.02, one-tailed). However, when task difficulty is low, Contribution does not significantly differ between the PPI and No PPI conditions ($F_{1,87}$ = 0.03; p = 0.89, two-tailed). Collectively, these results support H1, suggesting that when an individual productive task is relatively difficult, PPI that reveals performance *similarities* among employees in the individual productive task can *enhance* subsequent cooperation in a separate cooperative task.

[14] In an untabulated analysis, the amount of time spent in the Stage 1 task is not significantly associated with Contribution ($F_{1,182}$ = 0.38; p = 0.540, two-tailed). This evidence helps ruling out the alternative explanation that the Stage 1 effort provision reflects one's willingness to cooperate and leads to the pattern of Contribution in Stage 2.

[15] Because of the directional prediction in H1, I report one-tailed p-values for this test.

Test of H2: Peers with Dissimilar Performance

Panel A of Table 3 presents the results for participants in the Dissimilar Performance condition. Inconsistent with H2, I do not find that PPI has a significant negative effect on Contribution in the Dissimilar Performance condition ($F_{1,95}$ = 0.90; p = 0.35, two-tailed). Furthermore, the effect of PPI does not appear to depend on Task Difficulty ($F_{1,95}$ = 0.85; p = 0.36, two-tailed). These results suggest that PPI does not affect cooperation when individuals have dissimilar task performance. In the supplemental analyses section, I report additional analysis in the Dissimilar Performance condition to further explore these results.

Supplemental Analyses for Theory Testing

Effect of PPI on Self-Evaluation Deviation

A key element of my theory is that, without PPI, people tend to underestimate their relative performance for a difficult task but overestimate their relative performance for an easy task. By revealing the performance distribution in the peer group, PPI helps individuals mitigate their systematic bias in self-evaluation. To provide corroborating evidence for the theoretical rationale underlying my prediction and primary findings, I examine the effect of PPI on participants' self-evaluation of their relative performance. I expect that (1) participants have biases in their self-evaluation depending on the level of task difficulty; (2) PPI reduces participants' underestimation of relative performance when it bonds participants in the condition of Similar Performance and High Task Difficulty but has little effect in other conditions.

The post-experimental questionnaire asks participants to rate how they perceive their Stage 1 task performance.[16] Specifically, participants indicate whether they perceive their performance to be: (1) Way above average; (2) Above average; (3) About average; (4) Below average; or (5) Way below average. I then classify participants based on the quintile in which their actual task performance resides within their assigned condition. I calculate the difference between the quintile estimated by participants and the quintile indicated by their actual performance to construct a measure of Self-evaluation Deviation. This variable is above (below) zero if a participant overestimates (underestimates) his relative performance.

I plot the means of this Self-evaluation Deviation measure by condition in Figure 5. In the absence of PPI, Self-evaluation Deviation is mostly negative (positive) when task difficulty is high (low), suggesting that participants appear to underestimate (overestimate) their relative performance in the individual task. The most evident effect of PPI is in the Similar Performance condition and High Difficulty condition, where Self-evaluation Deviation becomes positive.

I then conduct an ANOVA with Self-evaluation Deviation as the dependent variable and PPI, Performance Similarity, and Task Difficulty as the independent variables. As reported in Table 4, I find a significant three-way interaction ($F_{1,156} = 3.02$; $p = 0.08$, two-tailed). I then conduct separate analyses for groups with similar or dissimilar peer performance. Panel A of Table 5 shows that, among participants in the Similar Performance condition, the effect of PPI on Self-evaluation Deviation

[16] I started collecting this variable after the initial administration, such that I have responses for 164 of the total 192 participants in the experiment.

significantly interacts with Task Difficulty ($F_{1,80}$ = 5.64; p = 0.02, one-tailed). Consistent with my prediction, follow-up analysis of this interaction, reported in Panel B of Table 5, suggests that PPI does not appear to have a significant effect on Self-evaluation Deviation when task difficulty is low ($F_{1,80}$ = 0.91; p = 0.17, one-tailed) but significantly mitigates participants' worse-than-average biases when task difficulty is high ($F_{1,80}$ = 17.23; p < 0.01, one-tailed). Interestingly, for these participants, PPI not only completely removes their worse-than-average bias (mean = -0.67 in No PPI condition) but also leads to an overestimation of relative performance (mean = 0.69 in PPI condition). One potential explanation is that bonding with their peers over similar performance leads participants to overestimate the relative performance of their group in the population and thus overestimate their own relative performance in the population when answering the post-experimental questionnaire question, irrespective of their position in the peer group.

Untabulated results indicate that PPI does not have a significant effect on participants' relative performance estimation for participants in the Dissimilar Performance condition ($F_{1,76}$ = 0.44; p = 0.51, two-tailed), irrespective of task difficulty ($F_{1,76}$ = 0.07; p = 0.79, two-tailed). This result suggests that participants do not appear to update their self-evaluation after PPI reveals they and their peers have dissimilar performance in the task.

Effect of PPI on Estimation of Others' Contributions

As discussed in the theory section, the bonding effect of PPI could increase individual contributions in two non-exclusive ways. First, individuals could contribute more because PPI increases their estimation of their group members' contribution.

Second, holding constant the estimation of their group members' contribution, individuals could contribute more because they care more about the group and are more willing to contribute to the group's success. To better understand the role of these two forces, I conduct the following analyses. First, I use the number of points that a participant estimates the other three group members invest in the group project (Estimation) as the dependent variable and conduct a three-way ANCOVA similar to that reported in Table 1. Untabulated results show that PPI does not have a significant main effect on Estimation ($F_{1,183} = 2.05$; $p = 0.15$, two-tailed), and that the effect of PPI does not interact with performance similarity or task difficulty (all $p > 0.37$, two-tailed). These results suggest that PPI does not appear to influence the extent to which participants believe their group members will contribute to the Stage 2 task.

Next, in untabulated analyses, I add Estimation as a covariate in the three-way ANCOVA in Table 1. Results shows that, although the effect of Estimation on Contribution is significant ($F_{1,182} = 219.60$; $p < 0.01$, two-tailed), the three-way interaction between PPI, Performance Similarity, and Task Difficulty remains significant ($F_{1,182} = 3.04$; $p = 0.08$, two-tailed). This result suggests that PPI appears to directly increase participants' willingness to cooperate with other group members when they have similar performance in a difficult task, independently of any influence of workers' estimates of others' contributions.[17]

[17] I find some evidence suggesting that participants' positive feelings towards their group members helps explain their willingness to cooperate. A post-experimental question asks participants to rate their level of agreement to the statement, "As a whole, I like my group members on a 7-point Likert-scale with endpoints of "Do not agree at all" (1) and "Very much agree" (7). Including this variable as a covariate reduces the significance of both the three-way interaction and the simple effect of PPI in High Difficulty and Similar Performance.

Supplemental Analyses for H1

Does the Bonding Effect Depend on the Shared Performance Level?

To the extent that PPI bonds individuals over common challenges in a difficult task, I expect the bonding effect of PPI to be stronger when individuals have similar poor performance than similar good performance. Within the subsample of High Task Difficulty and Similar Performance, I examine whether the positive effect of PPI on Contribution depends on the shared performance level in the Stage 1 task.

Although participants in the High Performance Similarity condition in general share relatively low performance when task difficulty is high, there is still some performance variation across groups, with the average performance for a group ranging from 4.5 to 23 in the Stage 1 task. I next run an untabulated regression analysis with Contribution as the dependent variable, PPI, the average Stage 1 task performance within a peer group, and their interaction as independent variables, and SVO as a covariate. I find a significant positive main effect of PPI on Contribution ($t_{43} = 2.65$; $p < 0.01$, one-tailed), confirming the general bonding effect of PPI in this condition. Interestingly, I also find a significant negative interaction effect between PPI and the group average Stage 1 task performance ($t_{43} = -2.09$; $p = 0.02$, one-tailed), indicating that the bonding effect of PPI in a difficult task is stronger when peers have similarly poor performance than when peers have similarly good performance. This result is consistent with the argument that the bonding effect of PPI occurs when revealing the shared struggle among individuals, further corroborating the theory underlying H1.

Motivational Effect of PPI in Stage 1

One potential concern for the bonding effect of PPI is that bonding over the similar performance in a difficult individual task could lead individuals to shirk in the individual task. Thus, to evaluate the overall benefits and costs of PPI, it is important to examine the effect of PPI in the individual productive task. I measure effort in the Stage 1 task using the number of seconds spent by an individual over the four work periods. I measure performance in the Stage 1 task using the total number of problems solved by a participant over the four work periods.

As shown in Table 6, PPI significantly increases the number of seconds participants willingly spend on the Stage 1 task ($F_{1, 184} = 2.85$; $p = 0.09$, two-tailed), even though participants receive fixed compensation and can choose to end a work period early. Moreover, this positive motivational effect does not significantly depend on task difficulty or performance similarity (all $p > 0.35$, two-tailed).[18] This finding suggests that providing employees with PPI on a challenging individual productive task could potentially increase both employees' individual task motivation and subsequent cooperation by revealing performance similarities in the individual task.

However, as shown in Table 7, I do not find PPI has a significant effect on task *performance* in Stage 1 ($F_{1,184} = 0.38$; $p = 0.54$, two-tailed). To better understand why there is a lack of performance effect given the presence of an effort effect (i.e., more time

[18] Given that the bonding effect could develop over time as PPI reveals performance (dis)similarity after each work period, I further examine whether there is any sign of effort reduction in the later work periods. In untabulated analyses, I use the number of seconds spent by an individual over the third and the fourth work periods as the dependent variable and find similar results. In particular, PPI significantly increases the time spent in the third and the fourth periods ($F_{1,184} = 2.99$; $p = 0.09$, two-tailed), and the effect does not interact with task difficulty or performance similarity (all $p > 0.30$, two-tailed).

spent), I first examine the pairwise correlation between the effort measure and the performance measure. I find the correlation between the effort measure and the performance measure is insignificant for both difficult and easy tasks (both $p > 0.39$, two- tailed). The correlation remains insignificant even if I remove participants with top and bottom 1% or 5% Stage 1 task performance for the two task conditions (all $p > 0.18$, two- tailed). This result suggests that the lack of performance increasing effect of PPI could be attributed to the fact that the experimental task in both High Task Difficulty and Low Task Difficulty conditions is more sensitive to ability than to effort.

Supplemental Analysis for H2

Role of Rank for Groups with Dissimilar Performance

As for the effect of PPI in the Dissimilar Performance condition, I explore whether the effect of PPI on cooperation varies for individuals with higher- and lower-than-average performance rankings in the peer group. I rank Stage 1 task performance of the four participants in each group whose members have dissimilar performance and conduct a three-way ANOVA with Contribution as the dependent variable, and PPI (No PPI versus PPI), Task Difficulty (High versus Low), and Rank (High versus Low) as independent variables. As reported in Table 8, I find some evidence that PPI reduces the contributions of participants ranking first and second in the group when task difficulty is high ($F = 2.95$; $p = 0.09$, two-tailed). PPI does not appear to have a significant effect on other participants in the Dissimilar Performance condition. Together with the evidence in the Similar Performance condition, these results suggest that PPI could have a positive effect on cooperation when employees have similar

performance but have limited negative effect on cooperation when employees have dissimilar performance.

Other Supplemental Analysis

***Similar vs. Dissimilar Performance in No PPI & High Task Difficulty* condition**

One notable pattern in results is the difference in Contribution between the Similar Performance condition (mean = 53.21) and the Dissimilar Performance condition (mean = 68.57; t_{54} = 1.57, p = 0.12, two-tailed) when there is no PPI and the task difficulty is high. As participants in these two conditions performed the same task and do not receive any feedback on their relative performance, my theory does not necessarily predict a significant difference in Contribution between the two conditions. In this section, I examine whether this difference is driven by the group composition difference across the two conditions. In particular, I examine whether this difference can be explained by participants with extreme performance levels, accurate self-evaluation deviation, or perceptions of similarity with peers without PPI across the two conditions. I also discuss whether the differences in group composition drive the main result in my study.

Extreme Performance

First, I examine whether the difference in task performance (Similar vs. Dissimilar) leads to the difference in Contribution between the two conditions. Because the assignment to either Similar Performance or Dissimilar Performance condition is based on the performance variance in a group, participants in the Dissimilar Performance condition are more likely to have extremely high and low task performance in Stage 1. I examine whether excluding participants with extreme performance can gap the difference

in Contribution. I exclude participants with top and bottom 5% performance in the high-difficulty task (three participants from the Similar Performance condition and nine participants from the Dissimilar Performance condition) and compare Contribution between the two conditions again.[19] After excluding these participants, although the mean Contribution does not appear to change much (54.80 in the Similar Performance condition 68.42 in the Dissimilar Performance condition), the difference between the two conditions becomes insignificant ($t_{42} = 1.18$; $p = 0.24$, two-tailed).

I next conduct the main ANCOVA analysis with the exclusion of participants with bottom and top 5% task performance in each condition. Figure 6 plots mean Contribution by condition. As reported in Table 9 and Table 10, the results remain the same. In particular, both the three-way interaction effect between PPI, Task Difficulty, and Performance Similarity ($F_{1,154} = 3.25$; $p = 0.07$, two-tailed) and the two-way interaction effect between PPI and task difficulty in the Similar Performance condition ($F_{1,81} = 1.62$; $p = 0.07$, one-tailed) remain significant. Simple effect analyses suggest that, after excluding participants with extreme performance, PPI still has a significant effect on Contribution when revealing similar performance in the difficult task ($F_{1,81} = 4.29$; $p = 0.02$, one-tailed), but not when revealing similar performance in the easy task ($F_{1,81} = 0.01$; p = 0.92, two-tailed).[20]

[19] The top and bottom 5% performance cutoff point for the high-difficulty task is 31 and 4 and the bottom and top 5% for the low-difficulty task is 46 and 16.

[20] These analyses remain robust if excluding participants with top and bottom 10% performance. The top and bottom 10% performance cutoff point for the high-difficulty task is 28 and 5 and the bottom and top 5% for the low-difficulty task is 45 and 20.

Self-evaluation Deviation

Next, I examine whether participants who do not underestimate their relative performance helps explain the difference in Contribution across the two conditions. As discussed in the supplemental analysis about Self-Evaluation Deviation, when task difficulty is high and there is no PPI, participants on average underestimate their relative performance. However, there are still some participants who overestimate or accurately predict their relative performance in this condition. I examine the difference in Contribution excluding these participants. First, I exclude participants whose Self-Evaluation Deviation is positive, i.e., overestimating their relative performance (one in Similar Performance condition and four in Dissimilar Performance condition). Excluding these participants from the subsample where there is no PPI and the task difficulty is high, the difference between the Similar Performance condition (mean = 55.22) and the Dissimilar Performance condition (mean = 69.00) is no longer significant (t_{41} = -1.25; p = 0.22). Next, I further exclude participants whose Self-Evaluation Deviation equals zero (ten in Similar Performance condition and ten in Dissimilar Performance condition). The difference between the Similar Performance condition (mean = 59.23) and Dissimilar Performance condition (mean = 57.00) remains insignificant (t_{21} = 0.14; p = 0.90).

To examine the impact on my main result, I conduct the main ANCOVA analysis with the exclusion of participants who have positive and zero Self-Evaluation Deviation in the in No PPI and High Difficulty condition. I plot the mean of Contribution for each condition in Figure 7. As reported in Table 11 and Table 12, the results become weaker. In particular, the three-way interaction in the main sample is longer significant ($F_{1,150}$ =

0.55; $p = 0.46$, two-tailed). In the Similar Performance condition, the two-way interaction effect between PPI and Task Difficulty is marginally significant ($F_{1,72} = 1.58$; $p = 0.10$, one-tailed), with a significant simple effect of PPI in the High Difficulty condition ($F_{1,72} = 2.17$; $p = 0.07$, one-tailed).

High Perceived Similarity

Lastly, I examine whether participants in these two conditions have different perception of their similarity with their group members. In the absence of PPI, there is no significant difference in how similar participants perceive themselves with their group members between these two conditions (3.50 in the Similar Performance condition vs. 3.75 in the Dissimilar Performance condition, $F_{1,54} = 0.48$; $p = 0.49$, two-tailed). However, compared with the Similar Performance condition, there are a few more participants in the Dissimilar Performance condition who perceive they are very similar with their group members. Specifically, while in the Similar Performance condition there are two participants who rate their similarity with their group members as greater than four on a 7-Likert scale, there are six participants whose answer is greater than four in the Dissimilar Performance condition. As the perception of similarity and Contribution is significantly positively correlated ($p = 0.02$, two-tailed), this may explain why the Contribution level is higher in the Dissimilar Performance condition for a difficult task with no PPI. Consistent with this possibility, after excluding participants whose response to the Similarity question is greater than four, the difference between the Similar Performance condition (mean = 54.62) and the Dissimilar Performance condition (mean = 61.82) becomes insignificant ($t_{48} = -0.67$; $p = 0.51$, two-tailed).

Next, I conduct the main ANCOVA analysis with the exclusion of participants in No PPI condition whose response to the Similarity question is greater than four. I plot the mean of Contribution for each condition in Figure 8. As reported in Table 13 and Table 14, the results become weaker but the inference remains the same.

Chapter 6: Conclusions and Future Research

Concluding Remarks

Employees often have access to performance information about their peers. Although prior research predominantly focuses on the performance *differences* revealed by such information, the central premise of my study is PPI in the form of absolute performance feedback can also reveal performance *similarities*. Under this premise, my study examines the effect of PPI in an individual productive task on individuals' willingness to cooperate with each other in a subsequent cooperative task. In a laboratory experiment, participants perform an individual math task and a subsequent public-goods game. I manipulate the presence of PPI and the difficulty level of the individual math task and measure performance similarity in the individual math task. I then examine the effect of PPI for the individual task on participants' contributions in the public-goods game.

Results indicate that the effect of PPI depends on both performance similarity and task difficulty of the individual productive task. In particular, consistent with my predictions, I find that when group members exhibit similar individual task performance, *and* when the individual task difficulty level is high, PPI significantly increases individual contributions in the subsequent public-goods game. This result suggests that PPI establishes a social bond among employees and enhances subsequent cooperation by revealing the challenge common to all group members. Conversely, when PPI reveals dissimilar performance among group members, PPI does not appear to affect subsequent cooperation except among relatively strong performers.

This study has important practical implications. First, it helps to explain why many organizations formally and informally provide employees with access to PPI on individual productive tasks despite the growing importance of employee cooperation and concerns over the possibly alienating effects of social comparison. My findings suggest that, when PPI reveals performance similarities among group members on a challenging individual task, PPI increases rather than decreases employee cooperation within the peer group. Second, my findings suggest that the bonding effect of PPI extends to cooperative tasks unrelated to the individual task to which the performance feedback pertains. This finding helps to explain why organizations often encourage employees to showcase their work. Third, I find that the bonding effect of PPI does not impair employees' motivation in the individual productive task. This result suggests that organizations can design feedback systems to achieve both the motivational benefits and the cooperation benefits of PPI. Lastly, the results show that the level of performance similarity between employees is an important moderator of PPI. As performance similarities often reflect the selection effect of other management control practices (e.g., Campbell 2012; Hales, Wang and Williamson 2014; Cardinaels, Chen, and Yin 2017), my study supports the reasoning that organizations should consider the interaction between different features of management control systems (Grabner and Moers 2013).

Limitations and Future Research Opportunities

Similar to other studies, limitations of this study provide opportunities for future research. First, future research can directly examine the effects on employees' subsequent cooperation of providing ranking feedback in addition to PPI in the form of absolute

performance level. The focus of the current paper is to examine the effect of the presence vs. absence of PPI on cooperation to provide the initial evidence. However, it would be interesting to further test my theory by manipulating whether participants only receive PPI, only receive the ranking information, or receive both PPI and the ranking information. To the extent that ranking information explicitly differentiates individuals even when they have similar performance, the bonding effect of PPI may diminish.

Second, I consider and operationalize employee cooperation as a benign action that increases the overall social welfare of participants. However, as suggested by prior literature, employees could also collude with each other at the cost of the organization (e.g. Evans, Moser, Newman and Stikeleather 2015). In my setting, I do not find evidence of collusive effort reduction in the Stage 1 task. However, future research may distinguish the circumstances under which the bonding effect over PPI leads to either beneficial cooperative or detrimental collusive behavior to the organization.

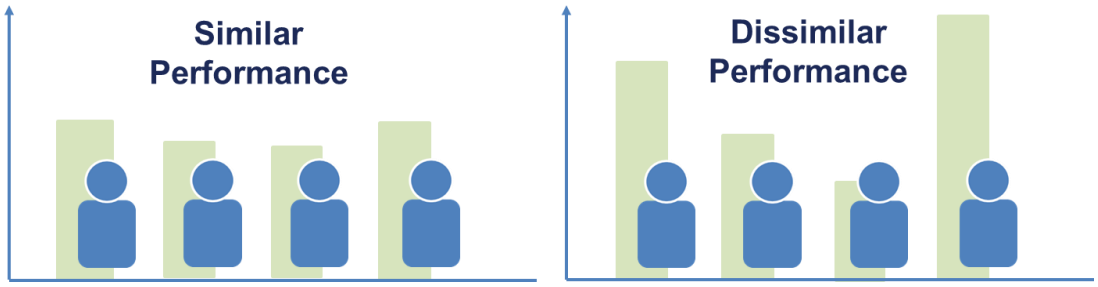
Third, the individual task performance in my study can be objectively measured (i.e., the number of math problems correctly solved). However, in practice, performance information can be qualitative and subjective, depending on the nature of the task (e.g., a creative task). Moreover, performance information about peers can be in the form of the work outcome itself, such as a completed project. Such performance information allows more ambiguity for employees to interpret whether peers have similar or dissimilar individual task performance. Even when the performance measure is objective, different calibration of the performance measure may also influence employees' perception of

their similarity. Future research could examine whether the effect of PPI interacts with various attributes of the underlying performance measure.

Fourth, I use a public-goods game as the cooperative task to capture the initial direct effect of PPI on subsequent cooperation. A public-goods game captures individuals' willingness to cooperate and represents the complementary nature of cooperation in practice, as the final cooperative output is greater than the sum of the collective inputs. Future research can test the robustness of the result in alternative cooperative tasks. Moreover, to capture the initial effect of PPI, I use a single-period public goods game. Future research could examine whether the effect of PPI becomes stronger or weaker when cooperation involves multi-period considerations. Lastly, in the experiment, participants are unaware of the public-goods game in Stage 2 when performing the Stage 1 task. In practice, employees could anticipate future cooperation opportunities when performing the individual task and receiving the related performance feedback. Future research could examine whether the knowledge of future cooperation opportunities interact with the effect of PPI.

Figures

FIGURE 1
PPI in Groups with Similar vs. Dissimilar Peer Performance



Group A **Group B**

FIGURE 2
Experimental Procedure

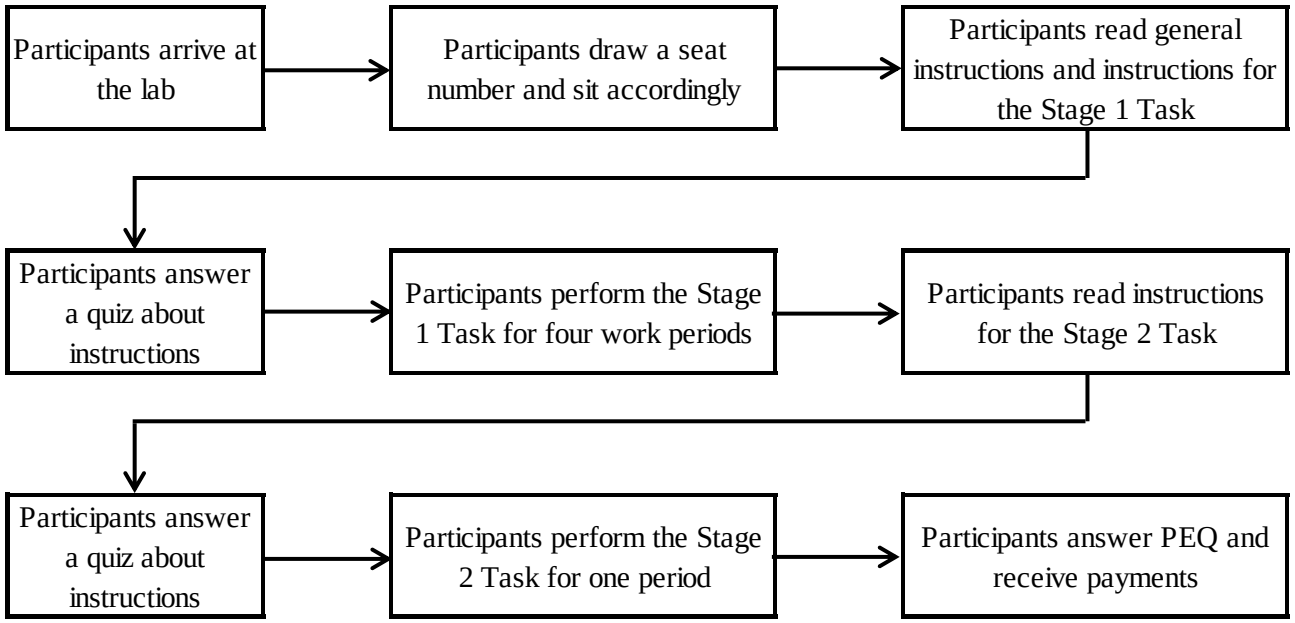


FIGURE 3
Examples of Performance Feedback in the Stage 1 (Math) Task

Panel A: No PPI Condition

Feedback after Each Period

Questions	**Seat 1**
Number of Correct Answers	

Feedback after All Four Periods

You have completed all four work periods for the Stage 1 Task. On the next screen, you will see a summary of the number of correct answers submitted by you over the four periods. Please click on the "Next" button to proceed.

	Seat 1
Period 1	
Period 2	
Period 3	
Period 4	

FIGURE 3 Cont.
Examples of Performance Feedback in the Stage 1 (Math) Task

Panel B: PPI Condition

Feedback after Each Period

Questions	Seat 1	Seat 2	Seat 3	Seat 4
Number of Correct Answers				

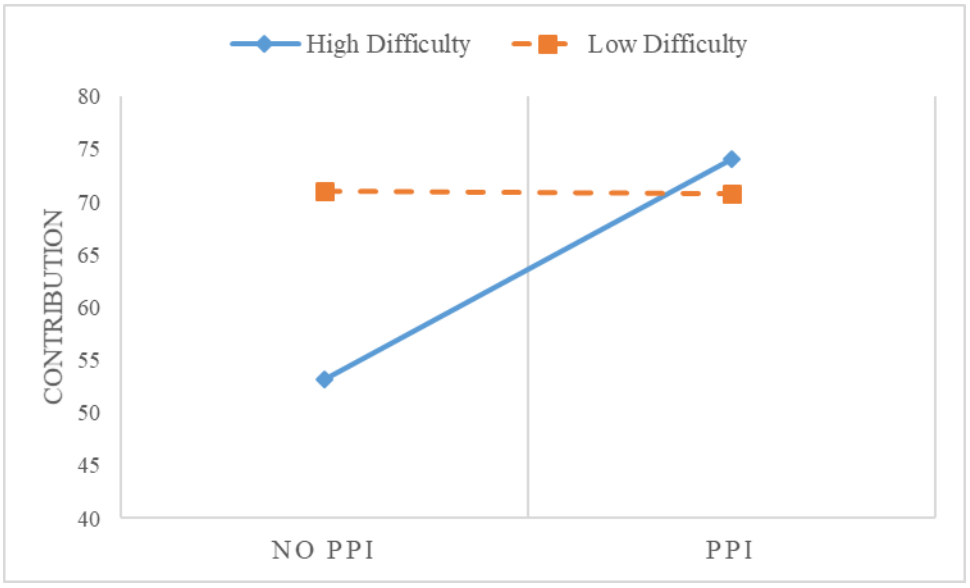
Feedback after All Four Periods

You have completed all four work periods for the Stage 1 Task. On the next screen, you will see a summary of the number of correct answers submitted by you and the other three participants in your group over the four periods. Please click on the "Next" button to proceed.

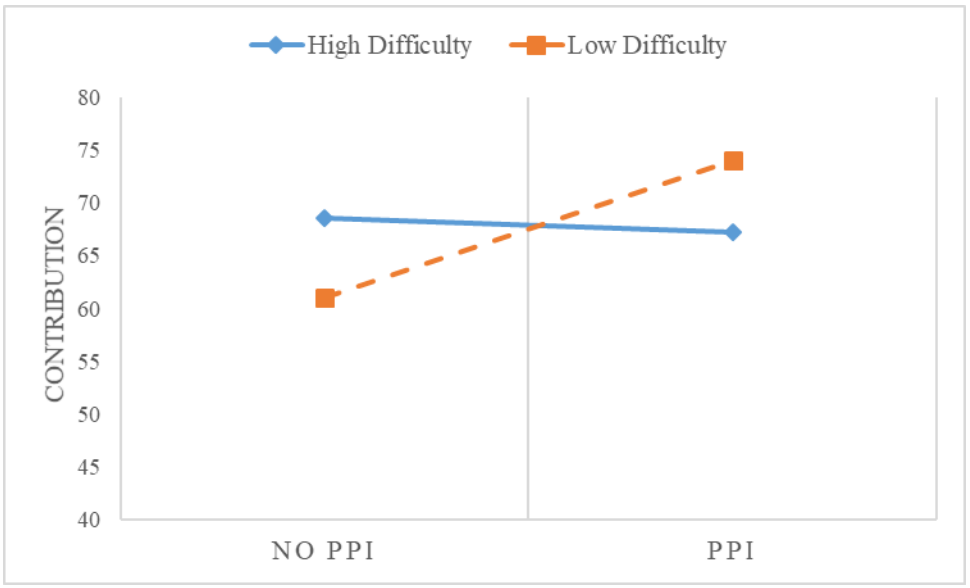
	Seat 1	Seat 2	Seat 3	Seat 4
Period 1				
Period 2				
Period 3				
Period 4				

FIGURE 4
Contribution

Panel A: Similar Performance condition



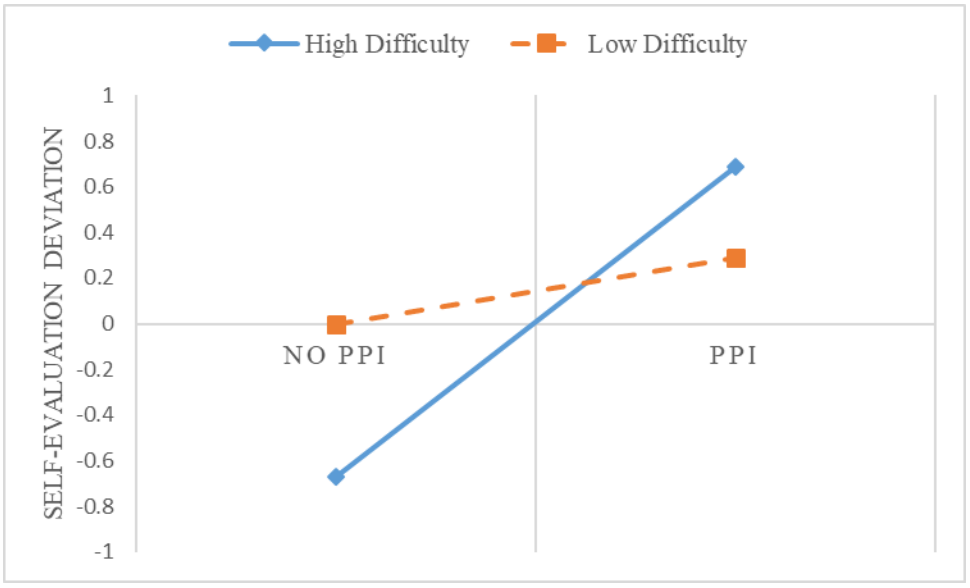
Panel B: Dissimilar Performance condition



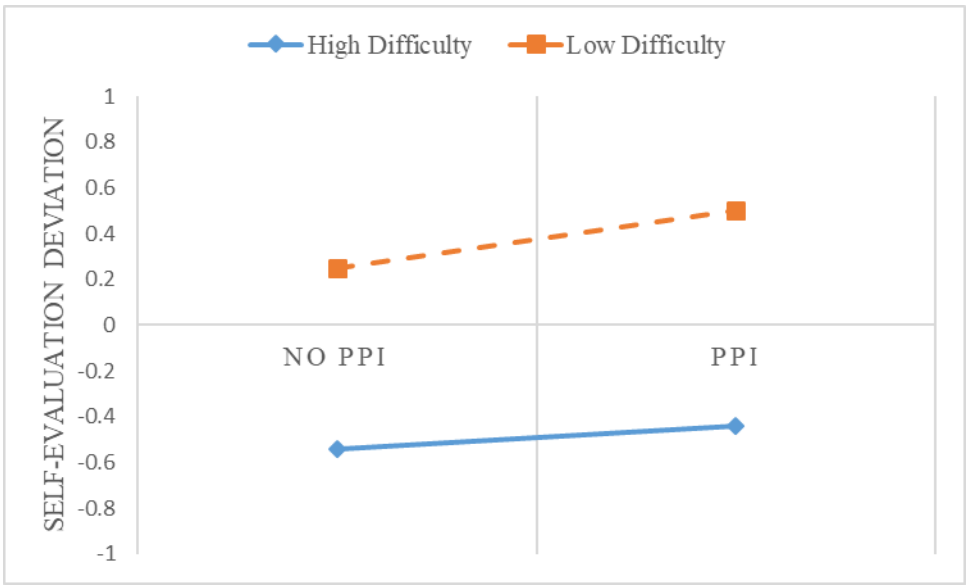
See variable descriptions in Table 1

FIGURE 5
Self-Evaluation Deviation

Panel A: Similar Performance condition



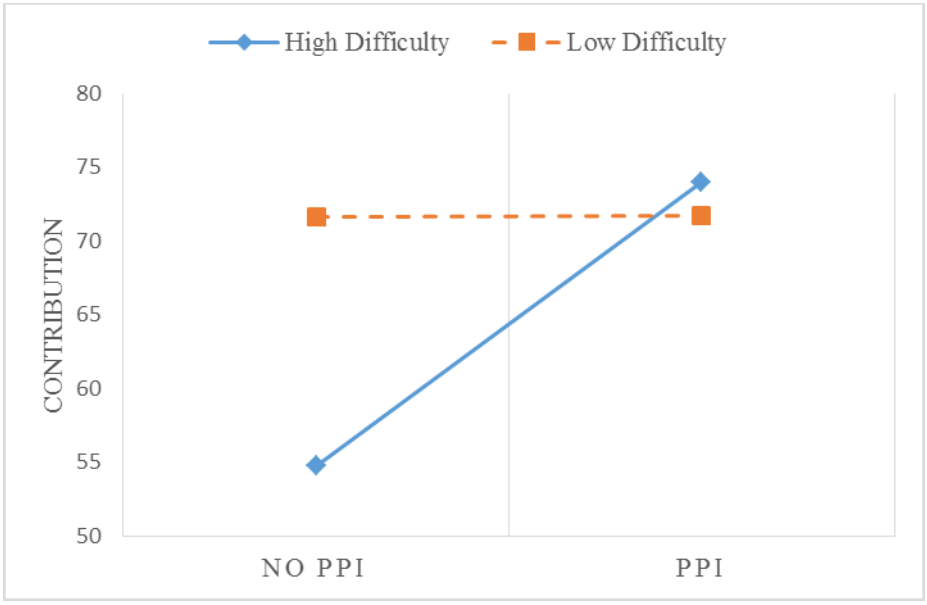
Panel B: Dissimilar Performance condition



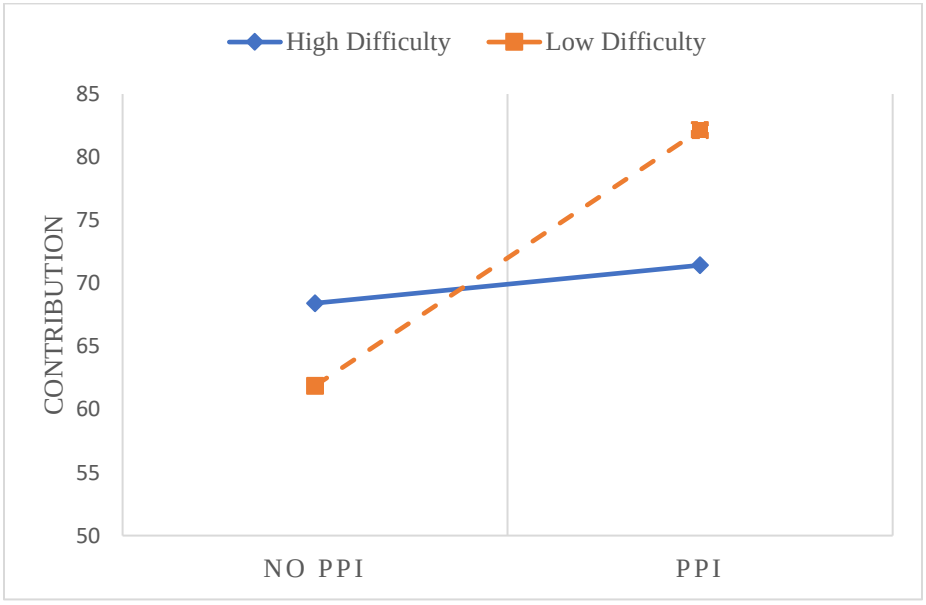
See variable descriptions in Table 4

FIGURE 6
Contribution in Subsample Excluding Participants with Top and Bottom Five Percent Performance

Panel A: Similar Performance condition



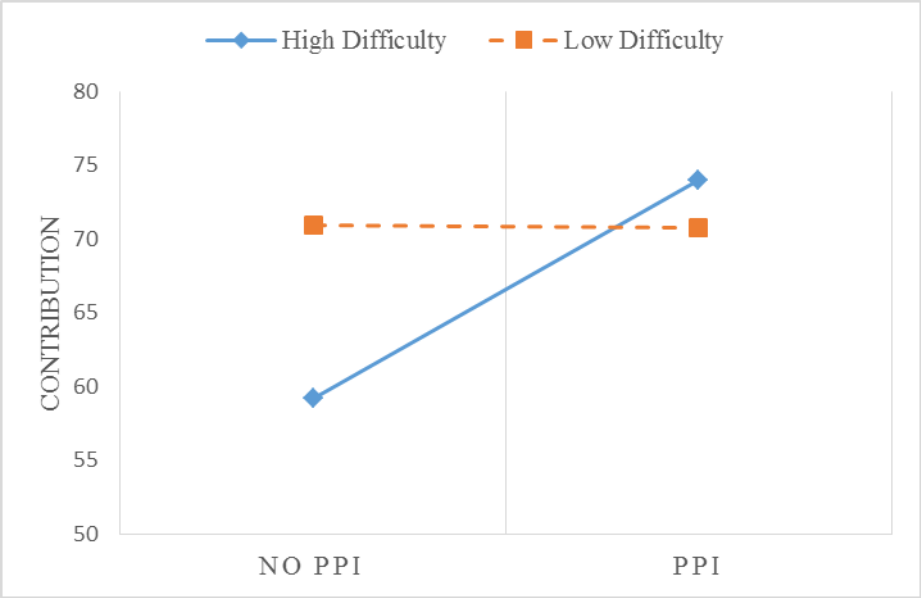
Panel B: Dissimilar Performance condition



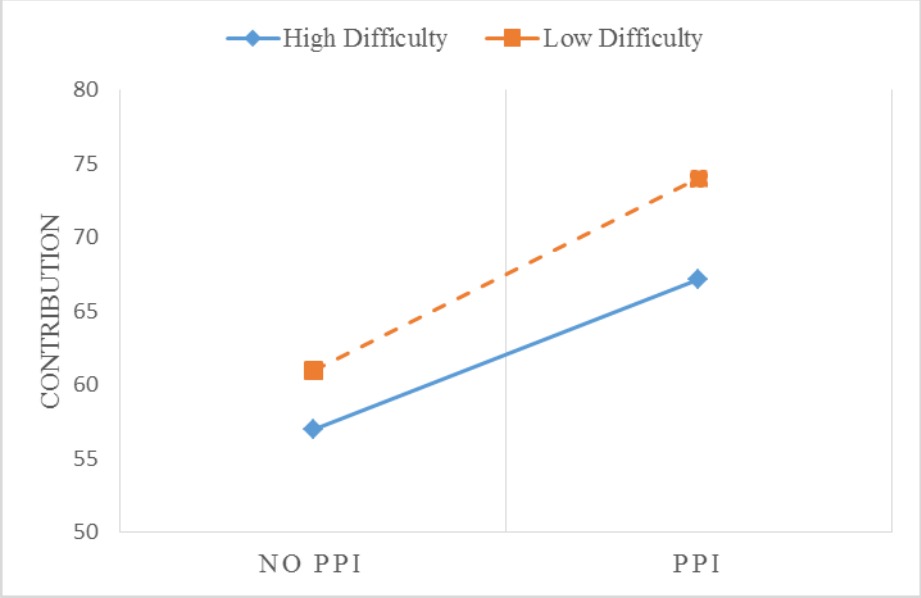
See variable descriptions in Table 1

FIGURE 7
Contribution in Subsample Excluding Participants with Positive and Zero Self-Evaluation Deviation in No PPI and High Difficulty condition

Panel A: Similar Performance condition



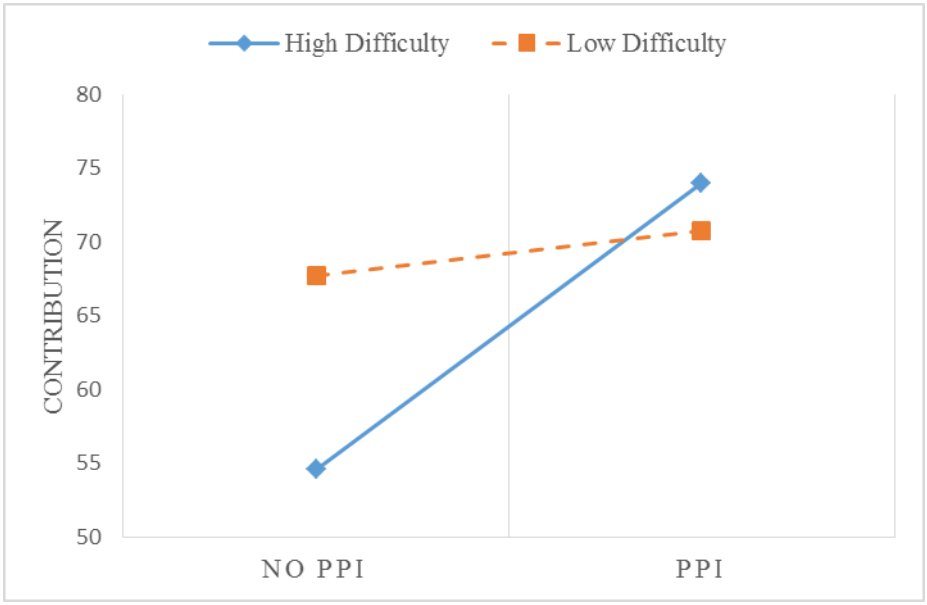
Panel B: Dissimilar Performance condition



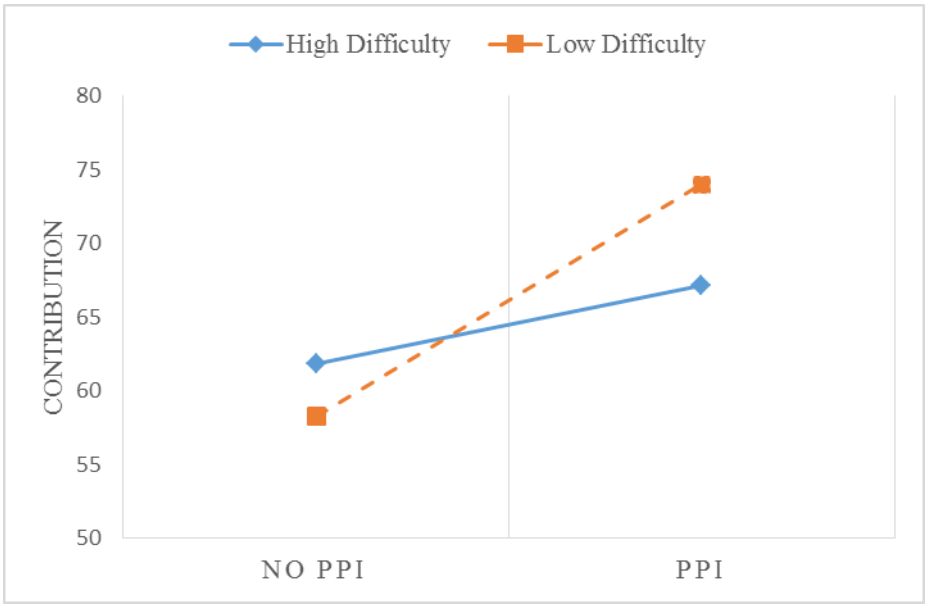
See variable descriptions in Table 1

FIGURE 8
Contribution in Subsample Excluding Participants Perceiving Similar as Peers without PPI

Panel A: Similar Performance condition



Panel B: Dissimilar Performance condition



See variable descriptions in Table 1

Tables

TABLE 1
Contribution in the Stage 2 Task

Panel A: Descriptive Statistics - Means [Median] (Standard Deviations)]

	Performance Similarity			
	Similar		Dissimilar	
Task Difficulty	No PPI	PPI	No PPI	PPI
High	53.21	74.00	68.57	67.19
	[55.00]	[75.00]	[85.00]	[90.00]
	(35.80)	(28.73)	(37.39)	(39.20)
	n=28	n=20	n=28	n=32
Low	71.00	70.83	61.00	74.00
	[90.00]	[70.00]	[60.00]	[80.00]
	(35.97)	(27.33)	(29.18)	(30.68)
	n=20	n=24	n=20	n=20

Panel B: Three-way ANOVA Tests

Source	*df*	Mean Square	*F*	*p*-value
PPI	1	3375.10	2.99	0.09
Task Difficulty	1	369.19	0.33	0.57
Performance Similarity	1	2.01	0.00	0.97
PPI × Task Difficulty	1	290.14	0.26	0.61
PPI × Performance Similarity	1	114.39	0.10	0.75
Task Difficulty × Performance Similarity	1	655.32	0.58	0.45
PPI × Task Difficulty × Performance Similarity	1	3822.75	3.39	0.07
SVO	1	5145.47	4.56	0.03
Error	183	1127.64		

1. *Contribution* is the number of points a participant chooses to invest in the group project in the public-goods game.
2. I manipulate the availability of PPI by varying whether participants learn the performance of each group member or not in addition to their performance after each period.
3. I manipulate Task Difficulty by either allowing participants to use pen and paper in the math task (Low Difficulty) or not (High Difficulty).
4. I classify a participant as being in a group with Similar (Dissimilar) Performance if performance variance of the group is below (at or above) the median of performance variance in its condition.
5. One-tailed p-values are indicated by boldface.

TABLE 2
***Contribution* in the Similar Performance Condition**

Panel A: Two-way ANOVA Tests

Source	*df*	Mean Square	*F*	*p*-value
PPI	1	2290.41	2.24	**0.07**
Task Difficulty	1	946.99	0.93	0.34
PPI × Task Difficulty	1	3056.61	2.99	**0.04**
SVO	1	3075.49	3.01	0.07
Error	87	1022.74		

Panel B: Simple Main Effect Tests

Simple Effects	*df*	*F*	*p*-value
Effect of PPI when Task Difficulty is High	1	5.39	**0.01**
Effect of PPI when Task Difficulty is Low	1	0.03	0.87

1. See variable descriptions for *Contribution*, *PPI*, *Task Difficulty*, and *Performance Similarity* in Table 1
2. One-tailed p-values are indicated by boldface.

TABLE 3
***Contribution* in the Dissimilar Performance Condition**

Panel A: Two-way ANOVA Tests

Source	*df*	Mean Square	*F*	*p*-value
PPI	1	1106.64	0.90	0.35
Task Difficulty	1	18.21	0.01	0.90
PPI × Task Difficulty	1	1049.89	0.85	0.36
SVO	1	2132.58	1.73	0.19
Error	95	1234.92		

Panel B: Simple Main Effect Tests

Simple Effects	*df*	*F*	*p*-value
Effect of PPI when Task Difficulty is High	1	0.00	0.98
Effect of PPI when Task Difficulty is Low	1	1.47	0.23

1. See variable descriptions for *Contribution*, *PPI*, *Task Difficulty*, and *Performance Similarity* in Table 1
2. One-tailed p-values are indicated by boldface.

TABLE 4
Self-Evaluation Deviation

Panel A: Descriptive Statistics - Means [Median] (Standard Deviations)]

	Performance Similarity			
	Similar		Dissimilar	
Task Difficulty	No PPI	PPI	No PPI	PPI
High	-0.67	0.69	-0.54	-0.44
	[-1.00]	[1.00]	[0.00]	[-0.50]
	(0.82)	(0.70)	(1.25)	(0.96)
	n=24	n=16	n=24	n=16
Low	0.00	0.29	0.25	0.50
	[0.00]	[0.00]	[0.00]	[0.00]
	(0.92)	(1.37)	(1.41)	(1.00)
	n=20	n=24	n=20	n=20

Panel B: Three-way ANOVA Tests

Source	*df*	Mean Square	*F*	*p*-value
PPI	1	10.00	8.28	<0.01
Task Difficulty	1	10.00	8.28	<0.01
Performance Similarity	1	0.73	0.61	0.44
PPI × Task Difficulty	1	2.10	1.74	0.19
PPI × Performance Similarity	1	4.17	3.45	0.07
Task Difficulty × Performance Similarity	1	5.32	4.40	0.04
PPI × Task Difficulty × Performance Similarity	1	3.65	3.02	0.08
Error	156	1.21		

1. *Self-Evaluation Deviation* is the difference between the quintile estimated by participants and the quintile indicated by their actual performance. If the variable is positive (negative), it suggests that individuals overestimate (underestimate) their relative performance.
2. See variable descriptions for *PPI*, *Task Difficulty*, and *Performance Similarity* in Table 1
3. One-tailed p-values are indicated by boldface.

TABLE 5
***Self-Evaluation Deviation* in Similar Performance Condition**

Panel A: Two-way ANOVA Tests

Source	*df*	Mean Square	*F*	*p*-value
PPI	1	13.83	13.54	<0.01
Task Difficulty	1	0.37	0.37	0.56
PPI × Task Difficulty	1	5.76	5.64	**0.02**
Error	80	1.02		

Panel B: Simple Main Effect Tests

Simple Effects	*df*	*F*	*p*-value
Effect of PPI when Task Difficulty is High	1	17.23	**<0.01**
Effect of PPI when Task Difficulty is Low	1	0.91	**0.17**

1. See variable descriptions for *Self-Evaluation Deviation*, *PPI*, *Task Difficulty*, and *Performance Similarity* in Table 1
2. One-tailed p-values are indicated by boldface.

TABLE 6
***Effort* in the Stage 1 Task**

Panel A: Descriptive Statistics - Means [Median] (Standard Deviations)

	Performance Similarity			
	Similar		Dissimilar	
Task Difficulty	No PPI	PPI	No PPI	PPI
High	694.93	717.48	708.30	714.32
	[720.00]	[720.00]	[720.00]	[720.00]
	(74.24)	(7.67)	(39.77)	(19.67)
	n=28	n=20	n=28	n=32
Low	713.38	715.66	708.50	715.36
	[720.00]	[720.00]	[720.00]	[720.00]
	(50.96)	(9.12)	(22.20)	(9.15)
	n=20	n=24	n=20	n=20

Panel B: Three-way ANOVA Tests

Source	*df*	Mean Square	*F*	*p*-value
PPI	1	4126.87	2.85	0.09
Task Difficulty	1	926.35	0.64	0.43
Performance Similarity	1	73.44	0.05	0.82
PPI × Task Difficulty	1	1097.35	0.76	0.39
PPI × Performance Similarity	1	414.65	0.29	0.59
Task Difficulty × Performance Similarity	1	687.99	0.47	0.49
PPI × Task Difficulty × Performance Similarity	1	1294.85	0.89	0.35
Error	184	1450.12		

1. *Effort* is the total number of seconds a participant voluntarily spends on the Stage 1 math task over the four work periods.
2. See variable descriptions for *PPI*, *Task Difficulty*, and *Performance Similarity* in Table 1
3. One-tailed p-values are indicated by boldface.

TABLE 7
***Performance* in the Stage 1 Task**

Panel A: Descriptive Statistics - Means [Median] (Standard Deviations)

	Performance Similarity			
	High		Low	
Task Difficulty	No PPI	PPI	No PPI	PPI
High	13.29	13.15	16.64	17.34
	[12.50]	[11.50]	[12.00]	[15.50]
	(6.58)	(5.42)	(12.34)	(8.19)
	n=28	n=20	n=28	n=32
Low	29.45	33.42	32.40	31.20
	[27.50]	[34.00]	[33.00]	[30.50]
	(7.35)	(7.31)	(10.83)	(12.29)
	n=20	n=24	n=20	n=20

Panel B: Three-way ANOVA Tests

Source	*df*	Mean Square	*F*	*p*-value
PPI	1	32.24	0.38	0.54
Task Difficulty	1	12667.10	149.90	<0.01
Performance Similarity	1	199.30	2.36	0.13
PPI × Task Difficulty	1	14.07	0.17	0.68
PPI × Performance Similarity	1	54.45	0.64	0.42
Task Difficulty × Performance Similarity	1	134.98	1.60	0.21
PPI × Task Difficulty × Performance Similarity	1	104.66	1.24	0.27
Error	184	84.50		

1. *Performance* is the total number of math problems correctly solved by a participant over the four work periods.
2. See variable descriptions for *PPI*, *Task Difficulty*, and *Performance Similarity* in Table 1
3. One-tailed p-values are indicated by boldface.

TABLE 8

***Contribution* for Low and High Rank in Dissimilar Performance Condition**

Panel A: Three-way ANOVA Tests

Source	*df*	Mean Square	*F*	*p*-value
PPI	1	780.02	0.68	0.41
Task Difficulty	1	5.24	0.00	0.95
Rank	1	2521.14	2.19	0.14
PPI × Task Difficulty	1	1264.50	1.10	0.30
PPI × Rank	1	1538.41	1.33	0.25
Task Difficulty × Rank	1	3035.43	2.63	0.11
PPI × Task Difficulty × Rank	1	2902.39	2.52	0.12
Error	92	1153.30		

Panel B: Follow-up Two-way Tests

Source	*df*	*F*	*p*-value
PPI × Task Difficulty at High Rank	1	3.58	0.06
PPI × Task Difficulty at Low Rank	1	0.14	0.71

Panel C: Follow-up Simple Effect Tests

Simple Effects	*df*	*F*	*p*-value
Effect of PPI at High Rank when Task Difficulty is High	1	2.95	0.09
Effect of PPI at High Rank when Task Difficulty is Low	1	1.11	0.30

1. Please see variable descriptions for *Contribution, PPI, Task Difficulty,* and *Performance Similarity* in Table 1
2. I rank participants based on their overall performance in the math task within each group. I assign participants ranked 1st and 2nd as High Rank and participants ranked 3th and 4th as Low Rank.
3. One-tailed p-values are indicated by boldface.

TABLE 9
Contribution **in the Subsample Excluding Participants with Top and Bottom Five Percent Performance**

Panel A: Descriptive Statistics - Means [Median] (Standard Deviations)]

	Performance Similarity			
	Similar		Dissimilar	
Task Difficulty	No PPI	PPI	No PPI	PPI
High	54.80	74.00	68.42	71.43
	[60.00]	[75.00]	[80.00]	[90.00]
	(37.32)	(28.73)	(37.89)	(36.88)
	n=25	n=20	n=19	n=28
Low	71.67	71.74	61.88	82.14
	[90.00]	[70.00]	[60.00]	[80.00]
	(36.01)	(27.58)	(26.88)	(22.25)
	n=18	n=23	n=16	n=14

Panel B: Three-way ANOVA Tests

Source	*df*	Mean Square	*F*	*p*-value
PPI	1	4840.73	4.51	0.04
Task Difficulty	1	612.68	0.57	0.45
Performance Similarity	1	265.82	0.25	0.62
PPI × Task Difficulty	1	37.19	0.03	0.85
PPI × Performance Similarity	1	91.66	0.09	0.77
Task Difficulty × Performance Similarity	1	330.99	0.31	0.58
PPI × Task Difficulty × Performance Similarity	1	3481.94	3.25	0.07
SVO	1	2594.69	2.42	0.12
Error	154	1072.50		

1. Please see variable descriptions for *Contribution, PPI, Task Difficulty,* and *Performance Similarity* in Table 1
2. One-tailed p-values are indicated by boldface.

TABLE 10
***Contribution* in the Similar Performance Condition Excluding Participants with Top and Bottom Five Percent Performance**

Panel A: Two-way ANOVA Tests

Source	*df*	Mean Square	*F*	*p*-value
PPI	1	1967.49	1.86	**0.09**
Task Difficulty	1	981.08	0.93	0.34
PPI × Task Difficulty	1	2366.90	2.23	**0.07**
SVO	1	2040.77	1.93	0.17
Error	83	1059.80		

Panel B: Simple Main Effect Tests

Simple Effects	*df*	*F*	*p*-value
Effect of PPI when Task Difficulty is High	1	4.29	**0.02**
Effect of PPI when Task Difficulty is Low	1	0.01	0.92

1. Please see variable descriptions for *Contribution, PPI, Task Difficulty,* and *Performance Similarity* in Table 1
2. One-tailed p-values are indicated by boldface.

TABLE 11
Contribution **in the Subsample Excluding Participants with Positive and Zero Self-Evaluation Deviation in No PPI and High Difficulty condition**

Panel A: Descriptive Statistics - Means [Median] (Standard Deviations)]

	Performance Similarity			
	Similar		Dissimilar	
Task Difficulty	No PPI	PPI	No PPI	PPI
High	54.80	74.00	68.42	71.43
	[60.00]	[75.00]	[80.00]	[90.00]
	(37.32)	(28.73)	(37.89)	(36.88)
	n=25	n=20	n=19	n=28
Low	71.67	71.74	61.88	82.14
	[90.00]	[70.00]	[60.00]	[80.00]
	(36.01)	(27.58)	(26.88)	(22.25)
	n=18	n=23	n=16	n=14

Panel B: Three-way ANOVA Tests

Source	*df*	Mean Square	*F*	*p*-value
PPI	1	4840.73	3.75	0.05
Task Difficulty	1	781.58	0.72	0.40
Performance Similarity	1	848.72	0.78	0.38
PPI × Task Difficulty	1	809.44	0.75	0.39
PPI × Performance Similarity	1	472.00	0.44	0.51
Task Difficulty × Performance Similarity	1	60.85	0.06	0.81
PPI × Task Difficulty × Performance Similarity	1	598.23	0.55	0.46
SVO	1	6953.92	6.43	0.01
Error	150	1081.99		

1. Please see variable descriptions for *Contribution, PPI, Task Difficulty,* and *Performance Similarity* in Table 1
2. One-tailed p-values are indicated by boldface.

TABLE 12
***Contribution* in the Similar Performance Condition Excluding Participants with Positive and Zero Self-Evaluation Deviation in No PPI and High Difficulty condition**

Panel A: Two-way ANOVA Tests

Source	*df*	Mean Square	*F*	*p*-value
PPI	1	804.66	0.97	**0.17**
Task Difficulty	1	197.91	0.21	0.65
PPI × Task Difficulty	1	1478.84	1.58	**0.10**
SVO	1	4076.68	4.36	0.04
Error	72	1059.80		

Panel B: Simple Main Effect Tests

Simple Effects	*df*	*F*	*p*-value
Effect of PPI when Task Difficulty is High	1	2.17	**0.08**
Effect of PPI when Task Difficulty is Low	1	0.05	0.83

1. Please see variable descriptions for *Contribution, PPI, Task Difficulty,* and *Performance Similarity* in Table 1
2. One-tailed p-values are indicated by boldface.

TABLE 13
***Contribution* in the Subsample Excluding Participants Perceiving Similar as Peers without PPI**

Panel A: Descriptive Statistics - Means [Median] (Standard Deviations)]

	Performance Similarity			
	Similar		Dissimilar	
Task Difficulty	No PPI	PPI	No PPI	PPI
High	54.62	74.00	61.82	67.19
	[55.00]	[75.00]	[80.00]	[90.00]
	(35.46)	(28.73)	(39.23)	(39.20)
	n=26	n=20	n=22	n=32
Low	67.78	70.83	58.24	74.00
	[85.00]	[70.00]	[60.00]	[80.00]
	(36.55)	(27.33)	(30.05)	(30.68)
	n=18	n=24	n=17	n=20

Panel B: Three-way ANOVA Tests

Source	*df*	Mean Square	*F*	*p*-value
PPI	1	5388.87	4.71	0.03
Task Difficulty	1	274.25	0.24	0.62
Performance Similarity	1	0.09	0.09	0.77
PPI × Task Difficulty	1	290.14	0.19	0.67
PPI × Performance Similarity	1	114.39	0.00	0.98
Task Difficulty × Performance Similarity	1	655.32	0.11	0.74
PPI × Task Difficulty × Performance Similarity	1	3822.75	1.88	0.17
SVO	1	5145.47	4.36	0.04
Error	170	1143.14		

1. Please see variable descriptions for *Contribution, PPI, Task Difficulty,* and *Performance Similarity* in Table 1
2. One-tailed p-values are indicated by boldface.

TABLE 14
***Contribution* in the Similar Performance Condition Excluding Participants Perceiving Similar as Peers without PPI**

Panel A: Two-way ANOVA Tests

Source	*df*	Mean Square	*F*	*p*-value
PPI	1	2590.69	2.59	**0.06**
Task Difficulty	1	352.88	0.35	0.55
PPI × Task Difficulty	1	1977.62	1.98	**0.08**
SVO	1	4092.60	4.10	0.05
Error	83	999.13		

Panel B: Simple Main Effect Tests

Simple Effects	*df*	*F*	*p*-value
Effect of PPI when Task Difficulty is High	1	4.78	**0.02**
Effect of PPI when Task Difficulty is Low	1	0.02	0.89

1. Please see variable descriptions for *Contribution, PPI, Task Difficulty,* and *Performance Similarity* in Table 1
2. One-tailed p-values are indicated by boldface.

Appendices: Experimental Materials

Appendix A

Experimental Instruction I

General Information

Thank you for participating in this study. Please carefully read the following instructions. You will complete a series of quiz questions about the instructions before proceeding to the study. Before beginning the specific instructions, please keep in mind the following rules:

1. NO DECEPTION

   This study will be carried out in the manner described to you, with no deception of any form. You will earn monetary compensation by performing tasks. You will receive all your compensation in cash at the end of today's session.

2. CONFIDENTIALITY

   To ensure confidentiality, your actions and decisions in the study will not be associated with your name.

3. NO TALKING

   Please do not talk at all with your fellow participants during the session. In addition, please do not talk about the study with other students who might participate in future sessions. Communication among participants could jeopardize the study. If you have any questions, please raise your hand and the administrator will come to you and answer your question privately.

Overview

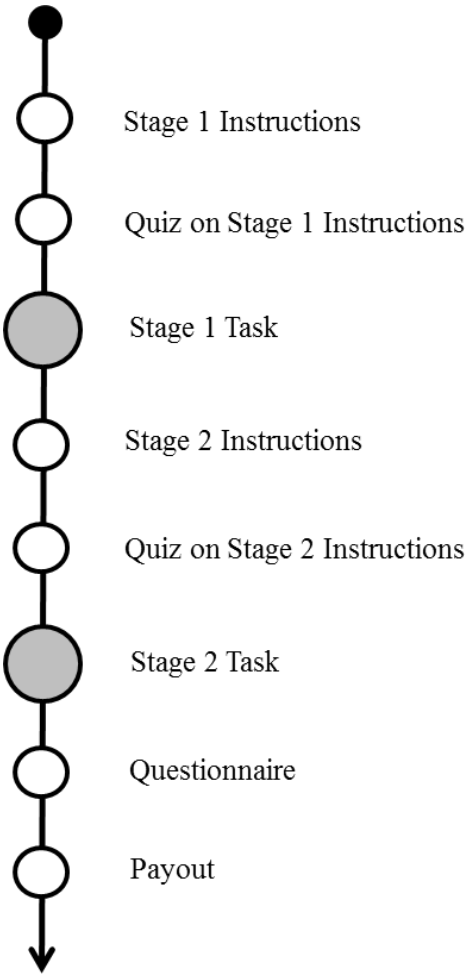
You have randomly drew a seat number in the beginning of the session. Your seat number will be your identifier in today's study.

Based on the seat number you randomly drew, we have assigned you to a four-person group. Your group members will remain the same throughout today's session.

The study includes two main stages. You will complete Stage 1 before proceeding to Stage 2. The Stage 2 task will be explained to you after Stage 1. You will be paid for performing tasks in each stage, as explained later.

After you finish both stages, you will complete a short questionnaire about the study. The entire session will take approximately 60 minutes.

The figure below summarizes the timeline of today's session.



Stage 1 Task

Task

Your task in Stage 1 is to solve two-digit multiplication problems. You will perform the task individually.

High Task Difficulty condition

Your task is to provide an answer for each problem. You must solve the problems without using a calculator, a pen and paper, or any other outside aid.

Low Task Difficulty condition

Your task is to provide an answer for each problem. You must solve the problems without using a calculator or any other outside aid, but you can use the pen and paper provided to you on the desk.

Below are two examples of the multiplication problems and their answers.

	Problem	Correct Answer
1.	39 × 80	3120
2.	42 × 35	1470

One tip for this task is to decompose the numbers to simplify the problem. For example, for 39 × 80, you can decompose 39 into 40 and -1. Then you can calculate 40 × 80 = 3200, and -1 × 80 = -80 separately. The answer will be the sum of the two numbers 3200 - 80 = 3120.

For 42 × 35, you can decompose 42 into 40 and 2. Then you can calculate 40 × 35 = 1400, and 2 × 35 = 70 separately. The answer will be the sum of the two numbers 1400 + 70 = 1470.

Work Period

You will perform the task for four periods. Each period you will receive 12 problems. You have a maximum of 180 seconds (three minutes) each period to work on the task. You will see a countdown timer on the top right-hand of the screen.

You can choose to end the work period early anytime before the period ends. Once you choose to end the work period early, you cannot restart the task in that work period, and you are free to relax and read the newspaper provided to you until the next work period starts.

If you choose to use the entire work period time, when the work period is over the computer will automatically end the task and ask you to submit your answers.

No PPI condition

At the end of each work period, you will see the output of your work, i.e. the answer you submited for each problem and the number of problems you correctly solved in that period.

PPI condition

At the end of each work period, you will also see the output of your group members. In particular, you will see the number of problems that each of the other three participants in your group correctly solved in that period. Your group members will see the number of problems that you correctly solved in that period as well.

Compensation

You will receive $8 for completing the Stage 1 task, irrespective of the number of problems you solve correctly.

Summary

	Stage 1 Task
What do I do?	Solve two-digit multiplication problems
How many periods?	Four periods; 12 problems per period.
How long each period?	180 seconds but participants are free to end the period early.
What feedback do I receive?	*No PPI condition:* You will see the number of problems correctly solved by you. *PPI condition:* You will see the number of problems correctly solved by you and by each of the three participants in his or her group. Your group members will also see the number of problem correctly solved by you

When do I receive feedback?	At the end of each period.
How much do I earn?	Every participant receives $8 for Stage 1.

Appendix B

Experimental Instruction II

Stage 2 Task

You will perform a task in Stage 2 with the other three members in your group. Your group members **are the same** as in Stage 1.

Your compensation in Stage 2 is calculated in points. At the end of the study, the total amount of points you earn will be converted to dollars at the rate of 10 points = $1 dollar.

Task Description

You and your group members each receive 100 points at the beginning of the period. Your task is to decide the amount of points to invest into a group project in an interval of 10 (e.g., 0, 10, 20, 30…100). You will keep the points that are not invested.

After the investment, the total number of points you and your group members invested in the group project is doubled. Each group member shares equally in the amount invested in the group project. Thus, the income for each group member will be

$$2 \times \text{sum of total investment in the group project} / 4 \text{ members}$$

Examples

If you and your group members each invest 100 points in the group project, the total investment is $100 \times 4 = 400$ points. This amount will be doubled to 800 points and then divided equally among the four group members. Each group member, including you, would receive 200 points.

If you invest 80 points and your group members on average invest 40 points in the group project, the total investment is $80 + 40 \times 3 = 200$ points. This amount would be doubled to 400 points and then divided equally among the four group members. Each group member, including you, would receive 100 points. Plus the 20 points you did not invest, you would receive $100 + 20 = 120$ points.

Decision

1. You will decide on how many of the 100 points you want to invest in the group project.
2. You will estimate the average amount of points the other three members in your group invest in the group project. If your estimate is within +/- 10 of the actual average, you will receive additional 10 points.

Your group members will have the same decisions to make as you. You will not know the decision made by your group members and your group members will not know your decision until the end of today's session.

Compensation

Your total compensation for the Stage 2 Task is:

Points that you do not invest (= 100 – investment to the group project) +

Points from the group project (= 2 × sum of total investment in the group project / 4) +

Points from guessing the average investment of other group members (= 10 if within 10 points of the actual average)

At the end of today's session, you will learn your total compensation for the Stage 2 Task. If it is not an integral number, it will be rounded to the nearest dollar.

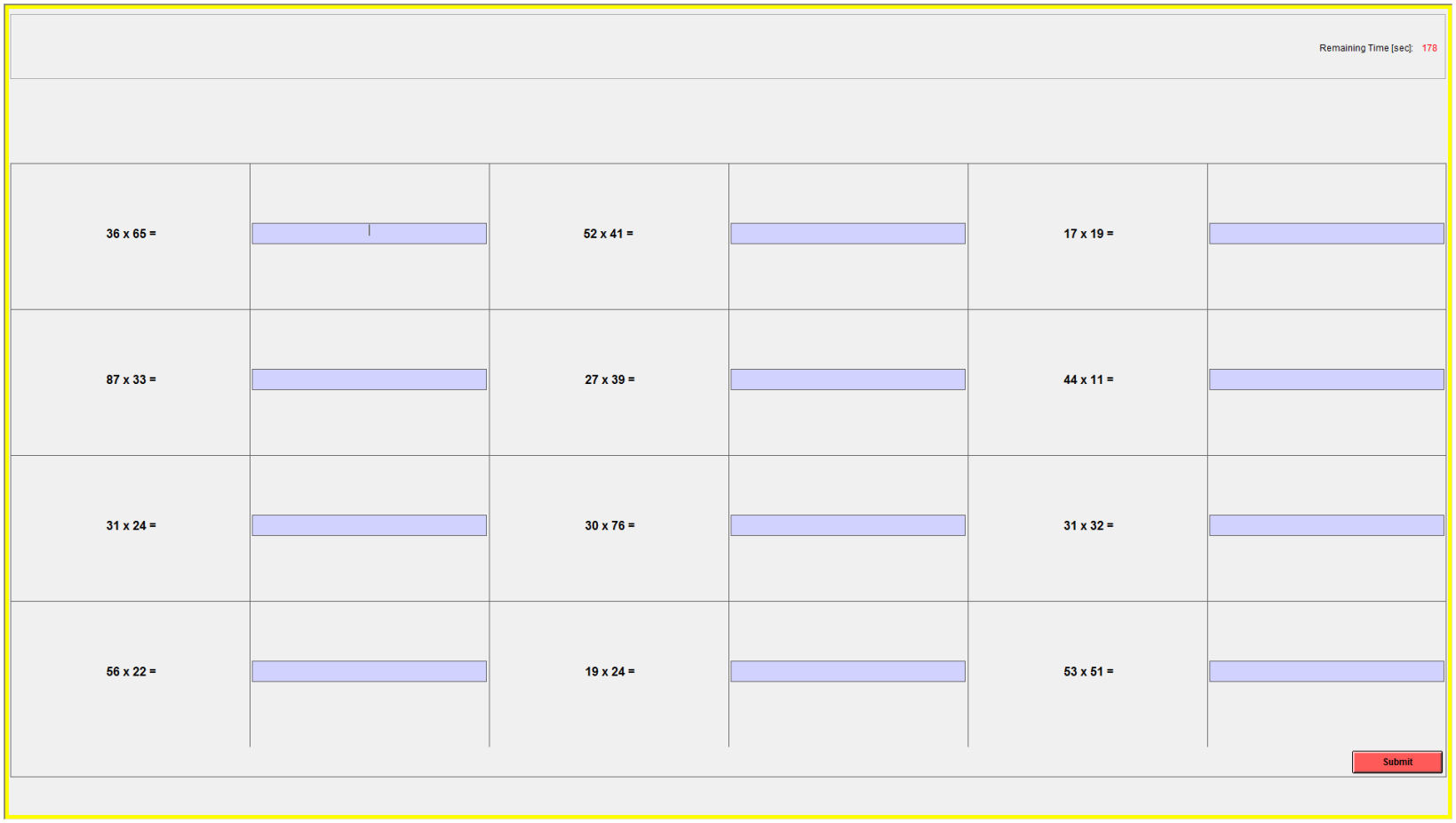
Summary

	Stage 2 Task
What do I do?	Decide how to many of the 100 points you want to invest in the group project; Estimate the average amount of points your three group members invest in the group project.
How many periods?	One period.
With whom do I work in the task?	Same group members as in Stage 1. Every participant will perform the task with all three other group members.
What feedback do I receive?	At the end of today's session, participants learn their total compensation in the Stage 2 Task and the average investment of the other three group members.
How much do I earn?	You will receive the sum of the points you do not invest and the points allocated from the group project. You will also receive a 10 point bonus if your estimate of the average investment of your group members is within 10 points of the actual average.

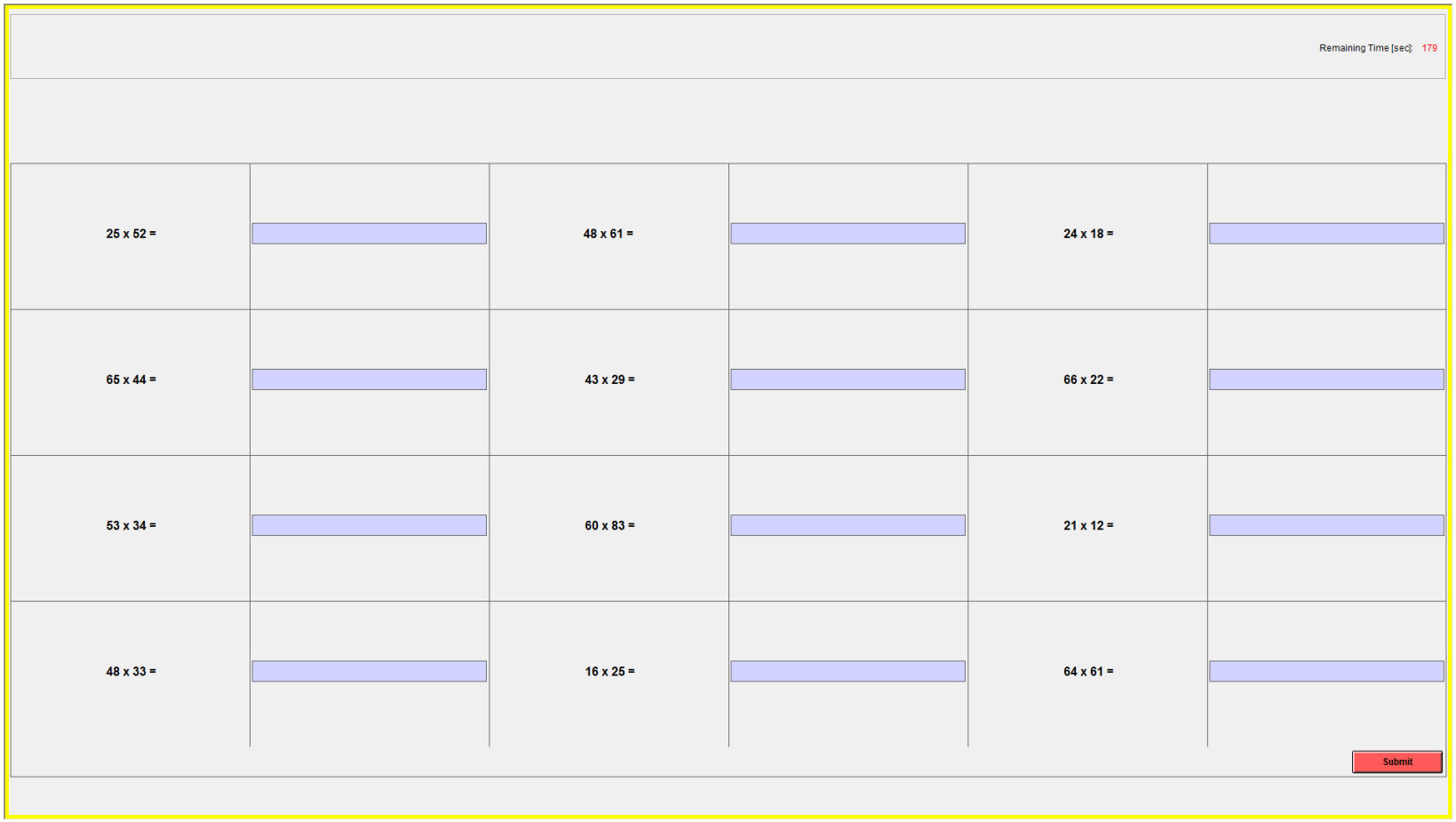
Appendix C

z-Tree Screens of the Stage 1 Task

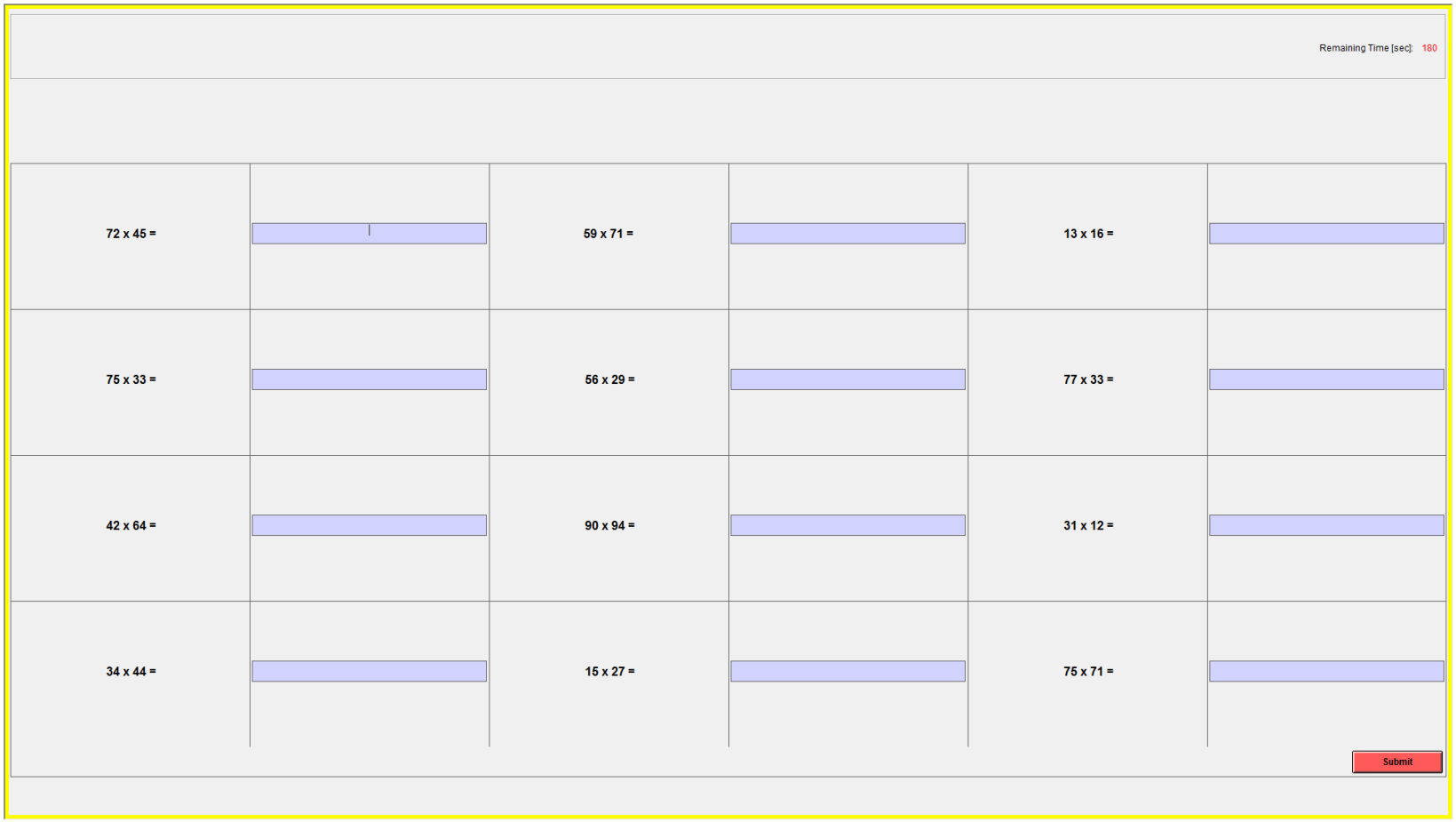
Period 1


Remaining Time [sec]: 178
36 x 65 =
52 x 41 =
17 x 19 =
87 x 33 =
27 x 39 =
44 x 11 =
31 x 24 =
30 x 76 =
31 x 32 =
56 x 22 =
19 x 24 =
53 x 51 =
Submit

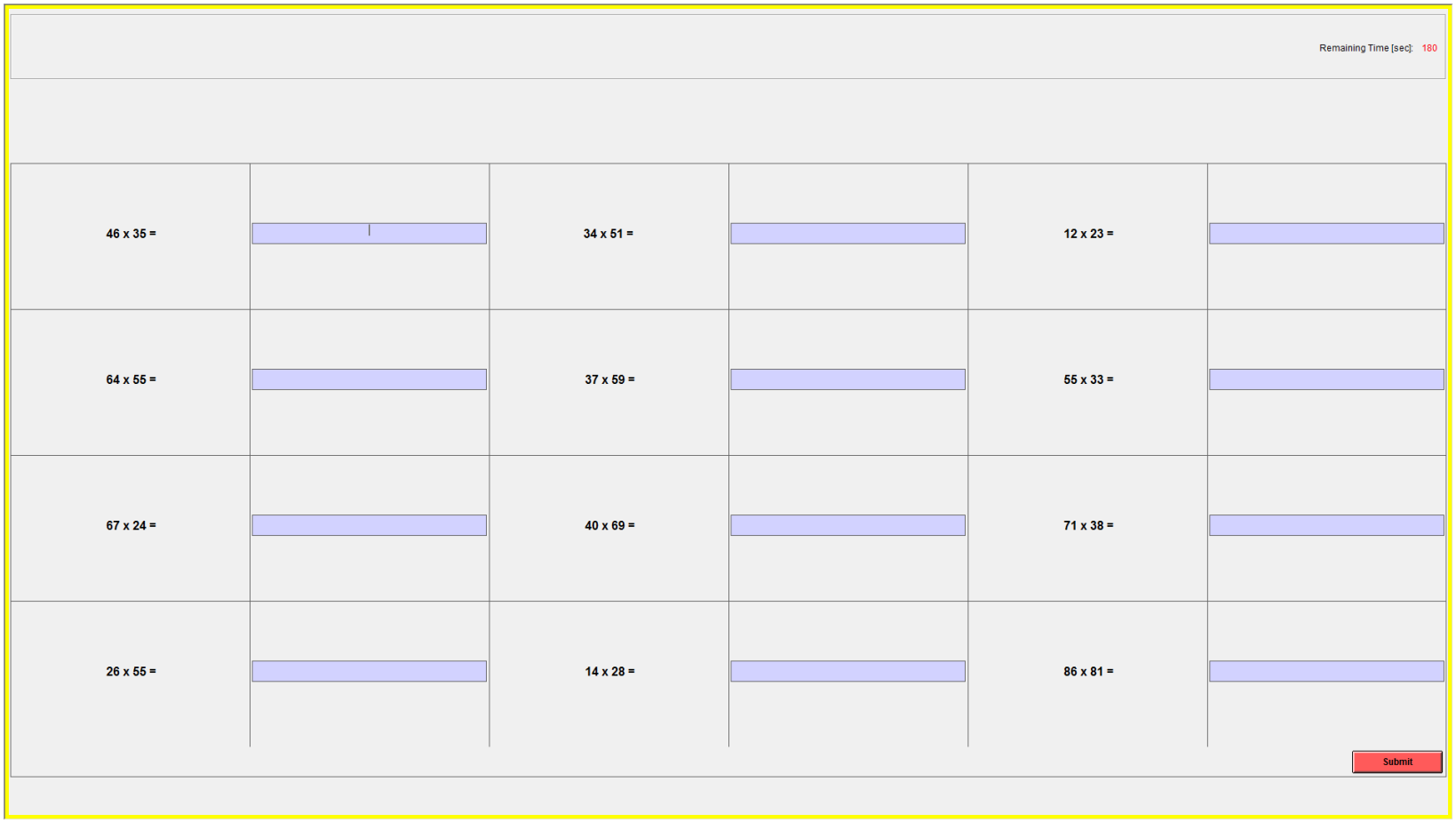
Period 2


Remaining Time [sec]: 179
25 x 52 =
48 x 61 =
24 x 18 =
65 x 44 =
43 x 29 =
66 x 22 =
53 x 34 =
60 x 83 =
21 x 12 =
48 x 33 =
16 x 25 =
64 x 61 =
Submit

Period 3


Remaining Time [sec]: 180
72 x 45 =
59 x 71 =
13 x 16 =
75 x 33 =
56 x 29 =
77 x 33 =
42 x 64 =
90 x 94 =
31 x 12 =
34 x 44 =
15 x 27 =
75 x 71 =
Submit

Period 4


Remaining Time [sec]: 180
46 x 35 =
34 x 51 =
12 x 23 =
64 x 55 =
37 x 59 =
55 x 33 =
67 x 24 =
40 x 69 =
71 x 38 =
26 x 55 =
14 x 28 =
86 x 81 =
Submit

Appendix D

Questionnaire

Please complete this questionnaire to help us better understand how you made your decisions today.

1. To what extent do you agree with the following statements related to the Stage 1 task?

a) I found the Stage 1 task *fun*.

1	**2**	**3**	**4**	**5**	**6**	**7**
Do not agree at all			Moderately agree			Very much agree

b) I found the Stage 1 task *challenging*.

1	**2**	**3**	**4**	**5**	**6**	**7**
Do not agree at all			Moderately agree			Very much agree

c) It was important for me to *perform well* in the Stage 1 task.

1	**2**	**3**	**4**	**5**	**6**	**7**
Do not agree at all			Moderately agree			Very much agree

d) I think performance in the Stage 1 task depends on one's *general intelligence level*.

1	**2**	**3**	**4**	**5**	**6**	**7**
Do not agree at all			Moderately agree			Very much agree

e) I think performance in the Stage 1 task depends on one's *effort level*.

1	**2**	**3**	**4**	**5**	**6**	**7**
Do not agree at all			Moderately agree			Very much agree

No PPI Condition

f) I would be *glad* if I can see the work output of my group members.

1	2	3	4	5	6	7
Do not agree at all			Moderately agree			Very much agree

g) I would be *glad* if my group members <u>could see</u> my work output.

1	2	3	4	5	6	7
Do not agree at all			Moderately agree			Very much agree

f) I was concerned about how well I did in the Stage 1 task *relative* to my group members.

1	2	3	4	5	6	7
Do not agree at all			Moderately agree			Very much agree

<u>*PPI Condition*</u>

g) I was *glad* to see the work output of my group members.

1	2	3	4	5	6	7
Do not agree at all			Moderately agree			Very much agree

h) I was *glad* that my group members <u>could see</u> my work output.

1	2	3	4	5	6	7
Do not agree at all			Moderately agree			Very much agree

i) I *compared* my output in the Stage 1 task with the output of my group members.

1	2	3	4	5	6	7
Do not agree at all			Moderately agree			Very much agree

j) I was concerned about how well I did in the Stage 1 task *relative* to my group members.

1	2	3	4	5	6	7
Do not agree at all			Moderately agree			Very much agree

2. To what extent do you agree with the following statements related to your group members in general?

a) As a whole, I *like* my group members.

1	2	3	4	5	6	7
Do not agree at all			Moderately agree			Very much agree

b) I feel *similar* to my group members.

1	2	3	4	5	6	7
Do not agree at all			Moderately agree			Very much agree

c) I feel *close* to my group members.

1	2	3	4	5	6	7
Do not agree at all			Moderately agree			Very much agree

d) I *trust* my group members.

1	2	3	4	5	6	7
Do not agree at all			Moderately agree			Very much agree

e) I feel my group members are *trustworthy*.

1	2	3	4	5	6	7
Do not agree at all			Moderately agree			Very much agree

f) I view my group members as *teammates*.

1	2	3	4	5	6	7
Do not agree at all			Moderately agree			Very much agree

g) I think my group members are *intelligent*.

1	2	3	4	5	6	7
Do not agree at all			Moderately agree			Very much agree

h) I think my group members are *competent*.

1	2	3	4	5	6	7
Do not agree at all			Moderately agree			Very much agree

i) I feel my group members are *cooperative*.

1	2	3	4	5	6	7
Do not agree at all			Moderately agree			Very much agree

j) I feel my group members are *competitive*.

1	2	3	4	5	6	7
Do not agree at all			Moderately agree			Very much agree

k) I would like to *spend some time* with the group members I was matched with.

1	2	3	4	5	6	7
Do not agree at all			Moderately agree			Very much agree

l) I *cannot* see myself being friends with my group members.

1	2	3	4	5	6	7
Do not agree at all			Moderately agree			Very much agree

m) If given the opportunity to perform the Stage 2 task with three other different participants, I would *prefer* to perform the tasks with <u>my current group members</u>.

1	2	3	4	5	6	7
Do not agree at all			Moderately agree			Very much agree

3.

a) I am *satisfied* with my performance in the **Stage 1 task**.

1	**2**	**3**	**4**	**5**	**6**	**7**
Do not agree at all			Moderately agree			Very much agree

b) How well do you think you performed in the **Stage 1 task**?

- o Way above average performance
- o Above average performance
- o About average performance
- o Below average performance
- o Way below average performance

c) I feel I was *competing* with my group members in the **Stage 1 task**.

1	**2**	**3**	**4**	**5**	**6**	**7**
Do not agree at all			Moderately agree			Very much agree

4. In your own words, please describe the factor(s) that influenced the number of points you invested in the group project in the **Stage 2 task**.

5. To what extent do you agree with the following statements about yourself?

a) I think *general intelligence* is an important ability to succeed in life.

1	**2**	**3**	**4**	**5**	**6**	**7**
Do not agree at all			Moderately agree			Very much agree

b) I always pay a lot of attention to how I do things compared with how others do things.

1	**2**	**3**	**4**	**5**	**6**	**7**
Do not agree at all			Moderately agree			Very much agree

c) If I want to find out how well I have done something, I compare what I have done with how others have done.

1	**2**	**3**	**4**	**5**	**6**	**7**
Do not agree at all			Moderately agree			Very much agree

d) I am not the type of person who compares often with others.

1	**2**	**3**	**4**	**5**	**6**	**7**
Do not agree at all			Moderately agree			Very much agree

e) I often compare myself with others with respect to what I have accomplished in life.

1	**2**	**3**	**4**	**5**	**6**	**7**
Do not agree at all			Moderately agree			Very much agree

f) I often try to find out what others think who face similar problems as I face.

1	**2**	**3**	**4**	**5**	**6**	**7**
Do not agree at all			Moderately agree			Very much agree

6. Please imagine that you have been randomly paired with another person. This person is someone you do *not* know and that you will *not* meet in the future. Below, you will make nine choices to *allocate hypothetical money* between you and the other person. **For each of the nine choices below, please circle either column A, B, or C to indicate the option that you prefer most.** There are no right or wrong answers. Please just choose the option that you prefer most. Note that each question below is <u>independent</u> of the other questions. That is, choices do not accumulate across questions.

1)

	A	**B**	**C**
You receive:	480	540	480
Other receives:	80	280	480

2)

	A	**B**	**C**
You receive:	560	500	500
Other receives:	300	500	100

3)

	A	**B**	**C**
You receive:	520	550	580
Other receives:	520	120	320

4)

	A	**B**	**C**
You receive:	500	560	490
Other receives:	100	300	490

5)

	A	**B**	**C**
You receive:	560	500	490
Other receives:	300	500	90

6)

	A	**B**	**C**
You receive	500	500	570
Other receives	500	100	300

7)

	A	**B**	**C**
You receive:	510	560	510
Other receives:	510	300	110

8)

	A	**B**	**C**
You receive:	550	500	500
Other receives:	300	100	500

9)

	A	**B**	**C**
You receive	480	490	540
Other receives	100	490	300

7. Below are six options. Each option has two possible outcomes and each outcome has a 50% probability of occurring. Although the payoffs are hypothetical, **please choose the option that is most attractive to you** as if the option you choose will generate actual payoffs to you.

Option	Outcome	Probability
A	$28	50%
	$28	50%
B	$24	50%
	$36	50%
C	$20	50%
	$44	50%
D	$16	50%
	$52	50%
E	$12	50%
	$60	50%
F	$2	50%
	$70	50%

More Questions on Next Page

8. Below is a list of words that describe feelings people have. **For each word, please circle the number that best describes the extent to which you have that feeling right now**.

	Not At All	A Little	Moderately	Quite a Lot	Extremely
Content	0	1	2	3	4
Sad	0	1	2	3	4
Excited	0	1	2	3	4
Tense	0	1	2	3	4
Confused	0	1	2	3	4
Angry	0	1	2	3	4
Anxious	0	1	2	3	4
Surprised	0	1	2	3	4
Enthusiastic	0	1	2	3	4
Interested	0	1	2	3	4
Calm	0	1	2	3	4
Happy	0	1	2	3	4
Ashamed	0	1	2	3	4
Proud	0	1	2	3	4

More Questions on Next Page

9. Please provide the following demographic information.

a. **Gender:** Male _____ Female _____

b. **Age:** _____

c. **Years of work experience:** _____

d. **Is English your first language?** Yes _____ No _____

e. **GPA:** _____

f. **Student status:**

a) Freshman
b) Sophomore
c) Junior
d) Senior
e) Graduate

g. **Academic major**

- Accounting
- Finance
- International Business
- Management
- Management Information Systems
- Marketing
- Science and Technology Management (STM)
- Supply Chain Management
- Business Analytics
- Technology Commercialization (MSTC)
- Other

h. **Have you attended other accounting research study before?**

Yes _____ No _____

You have now completed the questionnaire. Thank you!

PLEASE TURN BACK TO YOUR COMPTUER SCREEN NOW
AND ENTER THE FOLLOWING PASSCODE _____ TO PROCEED.

References

Amodio, D. M. and C. J. Showers. 2005. Similarity breeds liking revisited: the moderating role of commitment. *Journal of Social and Personal Relationships* 22(6): 817-836.

Ariely, D., and J. Levav. 2000. Sequential choice in group settings: taking the road less traveled and less enjoyed. *Journal of Consumer Research* 27 (December): 279–90.

Arnold, M., L. Hannan, and I. D. Tafkov. 2017. Mutual monitoring and team member communication in teams. Working Paper, University of Bern, Tulane University, and Georgia State University.

Arnold, M., L. Hannan, and I. D. Tafkov. 2018. Team member subjective communication in homogeneous and heterogeneous teams. *The Accounting Review* (forthcoming).

Balliet, D., C. Parks, and J. Joireman. 2009. Social value orientation and cooperation in social dilemmas: A meta-analysis. *Group Processes and Intergroup Relations* 12(4): 533-547.

Berger, J., and C. Heath. 2008. Who drives divergence? Identity signaling, outgroup dissimilarity, and the abandonment of cultural tastes. *Journal of Personality and Social Psychology* 95(3): 593 – 607.

Blanes i Vidal, J., and M. Nossol. 2011. Tournaments without prizes: evidence from personnel records. *Management Science* 57 (10): 1721-1736.

Brief, A.P. and S. J. Motowidlo. 1986. Prosocial organizational behaviors. *Academy of management Review* 11(4): 710-725.

Brown, J.L., J.G. Fisher, M. Sooy, and G.B. Sprinkle 2014. The effect of rankings on honesty in budget reporting. *Accounting, Organizations and Society* 39(4): 237-246.

Buunk, A. P. and F. X. Gibbons. 2007. Social comparison: The end of a theory and the emergence of a field. *Organizational Behavior and Human Decision Processes* 102(1): 3-21.

Byrne, D., G. L. Clore, and G. Smeaton.1986. The attraction hypothesis: do similar attitudes affect anything? *Journal of Personality and Social Psychology* 51: 1167–1170.

Camerer, C. and D. Lovallo. 1999. Overconfidence and excess entry: an experimental approach. *The American Economic Review* 89: 306–318.

Campbell, D. T. 1958. Common fate, similarity, and other indices of the status of aggregates of persons as social entities. *Behavioral Science* 3 (1): 14-25.

Campbell, D. 2012. Employee selection as a control system. *Journal of Accounting Research* 50(4): 931-966.

Cappelli, P., and A. Tavis. 2016. The Performance management revolution. Harvard Business Review (October).

Cardinaels, E., C. X. Chen, and H. Yin. 2017. Leveling the playing field: the selection and motivation effects of tournament prize spread information. *The Accounting Review* (forthcoming).

Cialdini, R. B. and K. D. Richardson. 1980. Two indirect tactics of image management: Basking and blasting. *Journal of Personality and Social Psychology* 39(3): 406 – 415.

Cialdini, R. B., and M. R. Trost. 1998. Social influence: social norms, conformity and compliance. In D. T. Gilbert, S. T. Fiske, and G. Lindzey (Eds.) *The Handbook of Social Psychology:* 151-192. New York: McGraw-Hill.

Chan, E. 2018. Promotion, relative performance information, and the peter principle. *The Accounting Review* (forthcoming).

Chan, E., S. J. Kachelmeier, and X.Y. Zhang. 2017. Working longer but not harder: The effects of input-based pay allocation and workforce composition on the duration and intensity of effort. Working Paper, The University of Texas at Austin.

Chen, C. X., M. G. Williamson, and F. H. Zhou. 2012. Reward system design and group creativity: An experimental investigation. *The Accounting Review* 87 (6): 1885-1911.

Cherry, T. L., S. Kroll, and J.F. Shogren, 2005. The impact of endowment heterogeneity and origin on public good contributions: evidence from the lab. *Journal of Economic Behavior & Organization* 57(3): 357-365.

Cohen, S. G. and D. E. Bailey. 1997. What makes teams work: group effectiveness research from the shop floor to the executive suite. *Journal of Management* 23(3): 239-290.

Coletti, A. L., K. L. Sedatole, and K. L. Towry. 2005. The effect of control systems on trust and cooperation in cooperative environments. *The Accounting Review* 80(2): 477-500.

Corsello, J. and D. Minor. 2017. Want to be more productive? Sit next to someone who is. Harvard Business Review (February 14) https://hbr.org/2017/02/want-to-be-more-productive-sit-next-to-someone-who-is

Cross. R, R. Rebele, and A. Grant. 2016. Cooperative overload (cover story). *Harvard Business Review* 94(1): 16.

Duhigg C. 2016. What Google learned from its quest to build the perfect team. The New York Times Magazine (February 25).

Dunn, J., N. E. Ruedy, and M.E. Schweitzer. 2012. It hurts both ways: how social comparisons harm affective and cognitive trust. *Organizational Behavior and Human Decision Processes* 117(1): 2-14.

Evans, J.H., D.V. Moser, A. H. Newman, and B. R. Stikeleather. 2016. Honor among thieves: Open internal reporting and managerial collusion. *Contemporary Accounting Research* 33(4): 1375-1402.

Falk, A. and A. Ichino.2006. Clean evidence on peer effects. *Journal of Labor Economics* 24(1): 39-57.

Festinger, L., 1954. A theory of social comparison processes. *Human Relations* 7(2):117-140.

Fischbacher, U. 2007. Z-Tree: Zurich toolbox for ready-made economic experiments. *Experimental Economics* 10 (2): 171-178.

Florida, R. and J. Goodnight. 2005. Managing for creativity. Harvard Business Review (July-August).

Frederickson, J.R., 1992. Relative performance information: The effects of common uncertainty and contract type on agent effort. *The Accounting Review* 67(4): 647-669.

Gibbons, F.X., and B.P. Buunk. 1999. Individual differences in social comparison: development of a scale of social comparison orientation. *Journal of Personality and Social Psychology* 76(1): 129 - 142.

Gino, F., and B.R. Staats. 2011. Driven by social comparisons: how feedback about coworkers' effort influences individual productivity. Working Paper, Harvard Business School.

Grabner, I., and F. Moers. 2013. Management control as a system or a package? Conceptual and empirical issues. *Accounting, Organizations and Society* 38 (6–7): 407-419.

Grant, A.M., and S. V. Patil. 2012. Challenging the norm of self-interest: minority influence and transitions to helping norms in work units. *Academy of Management Review* 37(4): 547-568.

Grant, A.M. 2013. *Give and Take: A Revolutionary Approach to Success*. Penguin.

Hales, J., and S. J. Kachelmeier. 2008. Predicting relative performance in economic competition. *The Journal of Behavioral Finance* 9(4):187-192.

Hales, J., L. W. Wang, and M. G. Williamson. 2014. Selection benefits of stock-based compensation for the rank-and-file. *The Accounting Review* 90(4): 1497-1516.

Hannan, R.L., R. Krishnan and A.H. Newman. 2008. The effects of disseminating relative performance feedback in tournament and individual performance compensation plans. *The Accounting Review 83*(4): 893-913.

Hannan, R. L., G. McPhee, A. H. Newman, and I. D. Tafkov. 2013. The effect of relative performance information on performance and effort allocation in a multi-task environment. *The Accounting Review* 88 (2): 553-575.

Hannan, R.L., G.P. McPhee, A.H. Newman, and I. D. Tafkov. 2018. The informativeness of relative performance information and its effect on effort allocation in a multi-task environment. *Contemporary Accounting Research* (forthcoming).

Haesebrouck, K., C. Martine, and A.G. Van den Abbeele. 2017. Status differences and knowledge transfer: The effect of incentives. *The Accounting Review In-Press.*

Haesebrouck, K., A.G. Van den Abbeele, and M.G. Williamson. 2015. The effects of knowledge sharing on helping behavior: Implications for reward system design. Working Paper, Maastricht University, KU Leuven, and University of Illinois Urbana Champaign.

Holmstrom, B. 1982. Moral hazard in teams. Bell Journal of Economics 13: 324–340.

Heap, S.P.H., A. Ramalingam, and B.V. Stoddard, 2016. Endowment inequality in public goods games: a re-examination. *Economics Letters* 146: 4-7.

Hess, A. 2017. The Science and design behind Apple's innovation-obsessed new workplace. CNBC (September 14).

Kachelmeier, S. J. 2018. Discussion of "The informativeness of relative performance information and its effect on effort allocation in a multi-task environment". *Contemporary Accounting Research* (forthcoming).

Kachelmeier, S.J. and Williamson, M.G., 2010. Attracting creativity: the initial and aggregate effects of contract selection on creativity-weighted productivity. *The Accounting Review* 85(5): 1669 -1691.

Kachelmeier, S. J., M.G. Williamson, and X.Y. Zhang. 2017. Cash vs. noncash reward: motivational effects of reward types for group performance. Working Paper, the University of Texas at Austin and University of Illinois Urbana Champaign.

Klar, Y. 2002. Way beyond compare: Non-selective superiority and inferiority biases in judging randomly assigned group members relative to their peers." *Journal of Experimental Social Psychology* 38(4): 331–351.

Klein, N., and N. Epley. 2015. Group discussion improves lie detection. *Proceedings of the National Academy of Sciences* 112(24): 7460-7465.

Kramer, S., V. S. Maas, and M. Van Rinsum. 2016. Relative performance information, rank ordering and employee performance: A research note. *Management Accounting Research* 33: 16-24.

Kruger, J. 1999. Lake Wobegon be gone! The "below-average effect" and the egocentric nature of comparative ability judgments. *Journal of Personality and Social Psychology* 77: 221–232.

Lazear, E. P. and S. Rosen. 1981. Rank-order tournaments as optimal labor contracts. *Journal of Political Economy* 89: 841-864.

Luft, J. 2016. Cooperation and competition among employees: experimental evidence on the role of management control systems. *Management Accounting Research* 31: 75 – 85.

Lynn, M., and C. R. Snyder. 2002. Uniqueness seeking. In: C. R. Snyder and S. J. Lopez (Eds.), *Handbook of Positive Psychology*: 395–410. London: Oxford University Press.

Maas, V.S., and H. Yin. 2018. Finding partners in crime? How internal transparency affects employee collusion. Working Paper. University of Amsterdam Business School. Nanyang Technological University.

Mas, A., and E. Moretti. 2009. Peers at work. *The American Economic Review* 99(1): 112-145.

McPherson, M., L. Smith-Lovin, J. M. Cook. 2001. Birds of a feather: Homophily in social networks. *Annual Review of Sociology* 27: 415–444.

Miller, D.T., J. S. Downs, and D.A. Prentice. 1998. Minimal conditions for the creation of a unit Relationship: The social bond between birthdaymates. *European Journal of Social Psychology* 28(3): 475-481.

Milliken, F.J., C. A. Bartel, and T. R. Kurtzberg. 2003. Diversity and creativity in work groups. *Group creativity: Innovation through collaboration*: 32-62.

Moore, D.A., 2007. Not so above average after all: When people believe they are worse than average and its implications for theories of bias in social comparison. *Organizational Behavior and Human Decision Processes* 102(1): 42-58.

Mussweiler, T., K. Rüter, and K., Epstude. 2004. The ups and downs of social comparison: mechanisms of assimilation and contrast. *Journal of Personality and Social Psychology* 87(6): 832 – 844.

Nalebuff, B.J., and J.E., Stiglitz. 1983. Prizes and incentives: towards a general theory of compensation and competition. *The Bell Journal of Economics* 14(1): 21-43.

Newman, A., and I. D. Tafkov. 2014. Relative performance information in tournaments with different prize structures. *Accounting, Organizations and Society* 39 (5): 348–361.

Newman, A., I. D. Tafkov. and F. H. Zhou. 2017. The Effects of incentive scheme and task difficulty on employees' altruistic behavior. Working Paper, University of South Carolina and Georgia State University.

Nielsen, C. 2016. How Microsoft used an office move to boost collaboration. Harvard Business Review (October). https://hbr.org/2016/10/how-microsoft-used-an-office-move-to-boost-collaboration

Nordstrom, R., P. Lorenzi, and R. Hall. 1991. A Review of public posting of performance feedback in work settings. *Journal of Organizational Behavior Management* 11 (2): 101-123.

O'Connell, V. O. 2008. Retailers reprogram workers in efficiency push. Wall Street Journal (September 10): B1.

Podsakoff, N.P., S.W. Whiting, P.M. Podsakoff, and B.D.Blume. 2009. Individual-and organizational-level consequences of organizational citizenship behaviors: A meta-analysis. *Journal of applied Psychology* 94(1): 122 – 141.

Rock, D., and B. Jones. 2015. Why more and more companies are ditching performance ratings. Harvard Business Review (September).

Rosen, A.S. 2018. Correlations, trends and potential biases among publicly accessible web-based student evaluations of teaching: A large-scale study of RateMyProfessors. com data. *Assessment and Evaluation in Higher Education* 43(11): 31-44.

Ross, M., and A. E. Wilson. 2002. It feels like yesterday: Self-esteem, valence of personal past experiences, and judgments of subjective distance. *Journal of Personality and Social Psychology* 82(5): 792 – 803.

Salovey, P., and J. Rodin, 1984. Some antecedents and consequences of social-comparison jealousy. *Journal of Personality and Social Psychology* 47(4): 780 – 792.

Schmitt, N., R.Z. Gooding, R.A. Noe, and M. Kirsch. 1984. Metaanalyses of validity studies published between 1964 and 1982 and the investigation of study characteristics. *Personnel Psychology* 37(3): 407-422.

Silverman, R. E. 2011. Latest game theory mixes work and play. Wall Street Journal (October 10): B11.

Smith, R. 2000. Assimilative and contrastive emotional reactions to upward and downward social comparisons. In Handbook of social comparison: Theory and research, edited by J. Suls, and L. Wheeler, 173-200. New York: Kiuwer Academic/Plenum Publishers. Snyder, Lassegard and Ford 1986

Snyder, C.R., M. Lassegard. and C.E. Ford. 1986. Distancing after group success and failure: Basking in reflected glory and cutting off reflected failure. *Journal of Personality and Social Psychology* 51(2): 382 - 388.

Sprinkle, G.B., and M.G.Williamson,. 2006. Experimental research in managerial accounting. *Handbooks of Management Accounting Research*: 415-444.

Stapel, D.A. and W. Koomen. 2005. Competition, cooperation, and the effects of others on me. *Journal of Personality and Social Psychology* 88(6): 1029 - 1038.

Suls, J., and L. Wheeler. 2000. Handbook of social comparison: Theory and research. New York: Kiuwer Academic/Plenum Publishers.

Tafkov, I. D. 2013. Private and public relative performance information under different compensation contracts. *The Accounting Review* 88 (1): 327-350.

Tesser, A., 1988. Toward a self-evaluation maintenance model of social behavior. *Advances in Experimental Social Psychology* 21: 181-227.

Tesser, A., N. Crepaz, J.C. Collins, D. Cornell, and S.R. H Beach. 2000. Confluence of self defense mechanisms: on integrating the self zoo. *Personality and Social Psychology Bulletin* 26: 1476–1489.

Thompson, L., and H. S. Choi. 2006. Creativity and innovation in organizational teams. Mahwah, NJ: Lawrence Erlbaum Associates.

Thomas T.F., and T. A. Thornock. 2017. Me vs. we: The effect of incomplete team member feedback on cooperation of self-regarding individuals. Working paper, University of Wisconsin-Madison and University of Nebraska-Lincoln.

Towry, K.L. 2003. Control in a teamwork environment: The impact of social ties on the effectiveness of mutual monitoring contracts. *The Accounting Review* 78(4):1069-1095.

Van Lange, P. M., De Bruin, E. N., Otten, W., and J. A. Joireman 1997. Development of prosocial, individualistic, and competitive orientations: Theory and preliminary evidence. *Journal of Personality and Social Psychology* 73(4): 733-746.

Waber, B., and J. Magnolfi, G. Lindsay. 2014. Workspaces that move people. Harvard Business Review (October).

Wang, L.W. 2017 Recognizing the best: The productive and counterproductive effects of relative performance recognition. *Contemporary Accounting Research* 34(2): 966 -990.

Woolley, K. and A. Fishbach. 2017. A Recipe for friendship: similar food consumption promotes trust and cooperation. *Journal of Consumer Psychology* 27: 1-10.

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